

**PANEL: MANAGING THE LOBSTER COMMONS: THE IMPORTANCE OF INFORMAL RULES**

*James M Acheson, University of Maine*

The Maine lobster industry is one of the world's most successful marine fisheries at present. The record high catches may be attributed in great part to state laws, which are effective in conserving the resource. Behind this successful management program is the existence of informal boundary rules and limited entry rules. These decentralized institutions make it possible for fishermen to monitor and sanction those who violate rules. They also give fishermen an incentive to support conservation rules by ensuring that those who sacrifice to maintain the resource will get most of the benefits. Boundary rules and limited entry rules are far more important for the management of common-pool resources than is generally recognized in the literature on common-pool resource management.

**DEVELOPING AN INTEGRATED MONITORING STRATEGY FOR NOAA'S NATIONAL MARINE SANCTUARY PROGRAM: PROGRESS TO DATE**

*Charles Edward Alexander, Stephen R. Gittings, Paul Samuel Orland, National Marine Sanctuary Program, NOAA*

NOAA's National Marine Sanctuary Program (NMSP) is in the process of developing a more consistent and integrated application of an ecosystem-based conceptual framework, design process, and reporting strategy to evaluate the status and trends of natural resources and the activities that affect them in National Marine Sanctuaries. The design and implementation processes consist of three increasingly specific phases: (1) objectives to metrics; (2) metrics to monitoring; and (3) monitoring to management. Phase one involves translating site-specific management objectives into supporting data collection metrics. It also includes an analysis of how a set of broad, system-wide themes on water quality, habitat quality, and living resource quality intersect site-specific priorities. Phase two involves translating the proposed metrics into data collection options and protocols that can detect change, and identifying how these options can be implemented. Phase three is actual implementation of data collection, analysis of results, and assessment of management options. The systematic application of this model across the NMSP is described and several case studies presented. The results of this process are expected to include a more rigorous and consistently applied set of data collection activities and assessment reports to measure and report on the natural resources and associated activities in National Marine Sanctuaries.

**EVALUATING THE CAPE WIND PARTICIPATORY PROCESS: CONFLICT AND CONFUSION?**

*Kimberly Amaral, Marine Affairs, University of Rhode Island*

Cape Wind Associates, a renewable energy developer, has applied for a permit with the U. S. Army Corps of Engineers to construct 130 wind turbines on a 24-mile-square area of Nantucket Sound called Horseshoe Shoal. In December 2001, the Corps determined that an Environmental Impact Statement was required for the wind farm project. Public comments relating to this project were reviewed and evaluated for the success of the participatory process. Evaluation criteria were deduced from recent Coastal Zone Management Proceedings on public participation as it relates to coastal and marine resource management (Morin, 2003). Areas of concern reflected in a review of public comments include the influence of participants and the exchange of best available information. Specific examples include the conflicting information provided on economic savings and the appearance of the turbines, as well as a perceived conflict of interest by stakeholders in a selection process under the Massachusetts Technology Collaborative. Future steps may include introducing economic, environmental, and aesthetic working groups into the current process.

**FUZZY JUDGMENT: THE PROCESS OF INCLUSION AND EXCLUSION OF COASTAL RESOURCE USERS IN FISHERIES CRITERIA-INDICATOR DEVELOPMENT**

*Merlina N. Andalecio, Dalhousie University*

Coastal resource users play a significant role in the development of criteria and indicators for fisheries management. As direct recipients of management, they may be considered as the best evaluators

of fisheries criteria and indicators. The judgment of coastal resource users on the importance of five criteria and twenty-four indicators in evaluating the impacts of fisheries management strategies in coastal municipalities of a Philippine bay was assessed using the Analytic Hierarchy Process (AHP). AHP, developed by Saaty (1980), determines the measure of importance of criteria and indicators through pairwise comparisons. The degree of consistency in the judgment was measured through a consistency ratio (i.e. a 10% or less consistency ratio is considered acceptable). What happens then when the judgment of resource users does not satisfy this acceptable level?

This paper discusses the process of selecting which measure of importance of the criteria and indicators from among the groups of resource users should be considered in the final evaluation of impacts when inconsistencies in judgment exist. Two approaches in dealing with this difficulty were recommended: 1) Select only the group or groups in each municipality whose consistency ratio is 10% or less in at least one of the criterion indicators and overall criteria, or 2) Application of a non-metric Multidimensional Scaling (MDS) technique.

### **COMPARISON OF THE INCORPORATION OF CLIMATE FORECASTS & OTHER CLIMATE INFORMATION BY COASTAL MANAGERS IN THE PACIFIC NORTHWEST BETWEEN 1996 & 2003**

*Melissa S. Andersen, Edward L. Miles, David L. Fluharty, School of Marine Affairs*

Coastal managers in the Pacific Northwest face impacts of climate variability and will increasingly face impacts of climate change. This study surveyed federal, state, local, and non-governmental natural resource agencies on their knowledge about climate variability and its probable impacts on coastal resources subject to their management responsibility. Elite surveys were conducted in 1997 through 1998 and again in 2003 with the person, or persons, within each agency deemed most knowledgeable about climate issues. The comparison of the results of the two sets of interviews indicate that since 1998: 1) individuals within these agencies have become more aware of climate issues; 2) there is an increase in the use of climate information by public non-governmental and emergency response agencies; 3) there is an increase in the perceptions of resource vulnerability to climate variability and change; but 4) coastal managers appear to be less interested in the incorporation of climate forecasts into management activities. A persistent distrust in the accuracy of forecasts has tended to limit the number of agencies that use such climate information in decision-making. An increase in understanding and documentation of the links between climate variability and changes in coastal resources would increase the relevance for coastal management. This research highlights the need for continued education and systematic interaction with coastal managers on the importance of the use of climate information in management of vulnerable coastal resources.

### **NEW INITIATIVES IN ECOSYSTEM MANAGEMENT ON NARRAGANSETT BAY**

*Thomas Ardito, Richard Ribb, Narragansett Bay Estuary Program*

In August, 2003, dissolved oxygen dropped to near-zero in Greenwich Bay, a cove on the west shore of Narragansett Bay, R.I. The event killed millions of menhaden and juvenile soft-shelled clams, galvanizing public and political resolve to improve Narragansett Bay's environment. The nutrient pollution that caused the fish kill is among a variety of problems facing the Bay: declining water quality, heavily utilized fisheries, beach and shellfish bed closures, and loss of fish and wildlife habitat. While welcomed by the public and stakeholders, this renewed focus on improving the Bay comes at a time when state budgets are tight, making it an even greater challenge to address these problems. The presentation will survey environmental issues on Narragansett Bay and profile new initiatives intended to reverse these trends, including the work of a new Governor's Bay & Watershed Commission, legislative initiatives, interstate cooperation, habitat restoration efforts, and work by the Narragansett Bay Estuary Program to support collaborative solutions and integrate science, policy, and public involvement through projects such as the Narragansett Bay Summit and the Narragansett Bay Journal.

## **THE PRECAUTIONARY APPROACH PUT INTO PRACTICE? A REVIEW OF AMERICA'S NATIONAL WILDLIFE REFUGE SYSTEM ON OUR COASTS AND WATERS**

*Dan Ashe, Susan White, Don Palawski, Gregory Siekaniec, Vernon Byrd, U.S. Fish & Wildlife Service*

Encompassing 95 million acres and 544 units, America's National Wildlife Refuge System is the world's largest system of lands and waters managed for wildlife. Roughly one-third of National Wildlife Refuges are located in coastal states and territories, from Maine to American Samoa, from Alaska to the Virgin Islands. Beginning 100 years ago, many refuges were created as safe-havens for migratory birds, waterfowl, and species of management concern. More recently, the historically loose confederacy of refuges has been more securely welded into a national network of ecosystem conservation units. In 1997, the National Wildlife Refuge System Administration Act was amended to conclusively establish a singular, wildlife conservation mission for the System, spell-out guidance for standardized management and compatible uses, identify priority public recreational uses, and require all refuges to undergo comprehensive conservation planning.

This paper examines the National Wildlife Refuge System Administration Act and its application in coastal and marine ecosystems. The application of the Act is evaluated with three specific coastal and marine examples, from very different environmental systems. The Alaska Maritime NWR (Alaska), J.N. "Ding" Darling NWR (Florida), and the Palmyra Atoll NWR (Pacific unincorporated territory) are examined in relation to their coastal management concerns, actions, and Act implementation. Management issues including public uses, habitat and species management, invasive species, law enforcement, wilderness and other special designation areas, and research and monitoring are gauged against the guidance incorporated in conservation-focused law. Authors include discussion on the concerns and opportunities with jurisdictional options with states, other federal agencies, and partners.

## **GUIDING NEW DEVELOPMENT AT THE WATER'S EDGE: SITE PLANNING & DESIGN PRINCIPLES**

*Farhad Atash, University of Rhode Island*

Waterfronts are important aesthetic, economic, and recreational resources. New development at the water's edge should preserve not only the economic vitality and recreational opportunities of the waterfront but its aesthetic diversity as well. In order to accomplish the latter, it is important to have appropriate site planning and design principles to guide the new development at the water's edge.

This paper has three objectives. First, it describes the process for preparation of site planning and design principles for waterfront areas. Second, the paper reviews major principles for development along the water's edge. These principles are divided into two categories: site planning and design. The first category entails three groups of principles dealing with site planning. These are for preserving public views of waterfront, enhancing public access to waterfront, and ensuring a compatible land use pattern for waterfront. The second group includes specific design principles for new development on waterfront. These are: architecture, building form and massing (height, bulk, and scale), outdoor public space design, streetscape design (road profile, sidewalk design, landscaping, street furniture and signage), and parking design. Lastly, the paper ends with a number of recommendations for implementation of design principles using administrative, financial, and regulatory tools.

## **COMMUNITY PARTICIPATION IN RESOURCE MANAGEMENT: THE CASE STUDY OF CEDHRAM AND THE SOUTHWEST WETLAND SYSTEM**

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Community participation can facilitate faster realization of holistic, sustainable management of resource systems and more effective use of often limiting management resources [time, personnel, money and infrastructural support]. It opens up the management system to "insider" information about the resource

system, which may be unavailable, or at minimum difficult to grasp where traditional management regimes consist of institutions, which are not an integral part of the resource system being managed.

This paper uses the experience of a local community organization, CEDHRAM, to build a case for including community participation in managing resource systems in Trinidad and Tobago. It explores the benefits and challenges of community-participatory management of the Southwest Wetland System.

This wetland system is located on Trinidad's southwestern peninsula encompassing approximately one-half of the land area, which is shared by the Cedros and Icacos communities. Its management has, at minimum, proved to be a challenge for the established management regime, spearheaded under the guidance of the Ministry of Environment and Human Development. Some of the challenges experienced by this management regime include insufficient knowledge about the wetlands and issues resulting from conflict between Government's management goals for the wetlands and the needs of residents in the surrounding communities.

### **WETLAND LOSS OR WETLAND GAIN: PLANNING FOR RISING SEA LEVEL IN COASTAL WILDLIFE REFUGES**

*Roger Barlow, Curt Larsen, Greg Desmond, Glenn Guntenspergen, Tom Yanosky, U.S. Geological Survey*

The current rates of relative sea level rise as well as an anticipated acceleration in rates associated with increasing global temperatures threaten a degree of inundation of low-lying coastal wildlife refuges along the U.S. East and Gulf Coasts. Inundation of present wetlands is commonly perceived as a loss of wetland area attributed to the inability of marsh surfaces to accrete vertically in keeping with the rate of sea level rise. Little attention is given, however, to the potential gain in wetland area created by the shoreward displacement of zoned vegetation that is propagated at the advancing edge of brackish to saline water onto adjacent upland land surfaces as sea level rises. Both loss and gain of wetland habitat need to be taken into account for any long- and short-range decision making affecting coastal wildlife refuges. If sustainable wetland resources are to be a desired objective, then adequate planning tools, based on sound science, need to be used to determine to compute the balance of loss versus gain in low-lying landscapes. Highly detailed elevation data called Light Detection and Ranging (LIDAR) has been collected for 3 National Wildlife Refuges (Blackwater, Prime Hook, and Bombay Hook) and decadal inundation models for sea-level rise have been created for review and analysis to plan future Refuge management strategies. A fourth Refuge, Loxahatchee has had high-accuracy elevation data collected using the USGS developed helicopter based Airbourne Height-Finder, and modeled results will be displayed on that data for this Refuge.

### **SEABED MAPPING IN THE NATIONAL MARINE SANCTUARIES**

*Brad Barr, NOAA/National Marine Sanctuary Program*

Seabed maps are an essential tool in the coastal and ocean resource manager's toolbox, but acquiring appropriate maps is a technologically complex and costly endeavor. The National Marine Sanctuary Program, in cooperation with the US Geological Survey and with the support and guidance of the University of New Hampshire's Center for Coastal and Ocean Mapping, has developed a strategy for seabed mapping in the 13 sanctuaries that focuses on creating high-resolution seabed maps, providing both detailed bathymetry and backscatter (a measure of substrate character). The maps are used to inform and guide the management of both natural and maritime heritage resources. Collected largely through the use of multibeam sonar, but also encompassing other mapping tools including side-scan sonar, sub-bottom profiling, LIDAR, and magnetometry, such data, once appropriately ground-truthed, can provide the basis for habitat mapping when combined with data on species distributions and other relevant biological information. These same data provide useful information in characterizing shipwrecks and other maritime heritage resources. Through a nearly two-year process, involving a series of workshops bringing together sanctuary managers, scientists and seabed mapping experts, the Sanctuary Program has established mapping goals, set area priorities across the Sanctuary System, and is now engaged in securing the resources necessary to implement this strategy.

## **VISUAL IMPACT ASSESSMENT OF DOCKS AND PIERS: THEORY AND PRACTICE**

*Steve Bliven*

From a manager's perspective, oftentimes the publicly-held concerns related to small docks are not really related to the environment. They may be aesthetic in nature, a sense of over-development of the shore, or simply change. While the aesthetic appeal of docks is an individual assessment, techniques have evolved that appear to provide reproducible or predictive assessments of the aesthetic values of an area and how those might change with development. Visual impacts assessments (VIAs) considering 1) landscape compatibility, 2) scale contrast, and 3) spatial dominance were developed by Richard Smardon of SUNY Albany. VIAs present respondents with concrete images showing how the visual landscape would be affected by proposed change. With computer technology, these doctored images are realistic and easy to make. VIAs indicate that, when shown two images of a shoreline, the vast majority of people select the same image as being aesthetically preferable, and results from these assessments are reliable and repeatable. Aesthetic or visual impacts have been used as a basis for denying permit applications in Maine and New York. This talk will introduce the theory of visual impact assessment, including definition of impacts, components of a visual assessment, how to decide when a visual assessment is necessary, and protocols for evaluating visual impacts. Examples of how VIAs have been used to ensure that proposed shoreline construction will not unreasonably interfere with existing scenic and aesthetic uses and avoidance, mitigation and offset measures to eliminate or reduce adverse impacts to existing scenic and aesthetic uses are discussed.

## **PUBLIC PERCEPTIONS OF ADAPTING TO COASTAL EROSION IN CALIFORNIA AND RHODE ISLAND**

*Carolynn Elizabeth Box, University of Rhode Island*

The appropriateness of using shoreline protection structures, such as seawalls and revetments, to reduce coastal erosion is strongly debated. Such structures may be viewed as successful in protecting buildings along the shoreline, but not in protecting beaches. As a result, there is no national consensus on how to control the development of shoreline protection structures along the coast. For this study, the survey technique is used to measure the public's perceptions concerning methods used to adapt to coastal erosion in Santa Cruz County, California and Washington County, Rhode Island. The public's perceptions of both counties are compared to each other and with each state's policies to better understand why the state regulations may differ regarding shoreline protection structures. Future management of the Nation's coasts is considered in light of these findings.

## **COASTAL GOVERNANCE: CIVIC ENVIRONMENTALISM AND COASTAL MANAGEMENT**

*Jeb Boyt, Attorney at Law*

Civic Environmentalism has emerged as a recent movement in environmental philosophy and practice. Civic Environmentalism has arisen, in part, as a reaction to the "command and control" regulation and recognizes as a public good community fellowship and place-based associations. By doing so, Civic Environmentalism attempts to carve a middle path between conservative ideologies with emphasis on free markets and property rights and liberal ideologies that emphasize government action and bioregional values. Where the limits of "command and control" regulation have been reached in terms of costs, political resistance, and feasibility on issues such as nonpoint source pollution control, civic environmentalism offers a means of restructuring public debate, focusing on ways that a community may address an issue. In this regard, Civic Environmentalism offers an approach that can be used to break impasses resulting from both property rights and Not-In-My-Backyard (NIMBY) objections. In many ways, Civic Environmentalism offers an ideological umbrella for many of the practices that coastal managers have been employing for years: education, watershed solutions, recognition local community interests and concerns. This presentation will describe how Civic Environmentalism may be used by coastal managers in addressing watershed issues such as nonpoint source pollution and habitat fragmentation and how Civic Environmentalism may provide a framework for measuring public involvement in coastal decision-making as it relates to coastal governance, water quality, coastal land use, and as a mechanism for habitat and ecosystem-based management.

## **THEORETICAL AND ACTUAL BIOLOGICAL EFFECTS OF FISHING QUOTAS IN ALASKA'S FISHERIES**

*Heather V Brandon, School of Marine Affairs, University of Washington*

Rationalization of fisheries management (including IFQs, ITQs, and cooperatives) is utilized primarily to achieve economic and social objectives. The biological consequences of rationalization are largely theoretical and are based on predictions of the fisheries market and human fishing behavior. Very little analysis has been conducted to verify whether the anticipated biological effects have occurred or not.

The question central to my thesis is: Do rationalization programs produce the anticipated biological impacts? And are there additional biological effects from rationalization that were not predicted?

This poster will examine the five key biological assumptions made within two case study fisheries: Alaska pollock and halibut/sablefish. Additionally, this poster will highlight the findings of actual biological impacts from these two rationalized fishery programs. Additionally, I will acknowledge those assumptions that cannot be verified due to lack of information. Identifying gaps in data will allow me to recommend monitoring and research for future fishery rationalization programs.

## **DRAFT NATIONAL COASTAL CONDITION REPORT II**

*Barry Burgan, U.S. EPA*

The National Coastal Condition Report II describes the ecological and environmental conditions in U.S. coastal waters. It summarizes the condition of ecological resources in the estuaries of the United States and highlights several exemplary federal, state, tribal, and local programs that assess coastal ecological and water quality conditions. Like the first Report released in 2001, this report rates the overall condition of U.S. coastal waters as fair to poor, varying from region to region. It represents a coordinated effort among EPA, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, the U.S. Fish and Wildlife Service and coastal states. EPA expects to release this report in the fall of 2004. The draft Report is based on data collected from a variety of federal, state, and local sources, most notably EPA's National Coastal Assessment Program. These data sets include over 50,000 samples taken from 1997 to 2000 at over 2,000 randomly selected sites in all continental U.S. seacoasts and Puerto Rico. The resulting ecological assessment of the nation's estuaries shows estuaries to be in fair condition, varying from poor conditions in the Northeast and Puerto Rico to fair conditions in the Southeast, Gulf of Mexico, Great Lakes and West Coast. A brief description of each indicator in the current draft is as follows: Water Quality Index: An index combining the condition associated with five water quality measurements (dissolved oxygen, nitrogen, phosphorus, chlorophyll a, and water clarity); Benthic Index or a surrogate measure is poor for benthic communities.

## **TOOLS FOR MONITORING COASTAL HABITATS**

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Coastal habitats support many wildlife functions (e.g. providing shelter, breeding, feeding and nursery grounds) some of which are also important economically. Anthropogenic sources are primarily responsible for habitat deterioration. To encourage persons to support management and restoration monitoring of coastal habitats, they must understand the habitat's ecological value and how the habitat's health relates to their economic and social status. In response, NOAA is developing ecological and socioeconomic guidance to help those interested in coastal restoration efforts (e.g., private citizens, NGOs, government agencies) to identify potential parameters for monitoring the success or failure of coastal restoration projects. The manual provides technical assistance in the development and implementation of sound, scientific monitoring of marine and coastal freshwater restoration efforts (including areas within the Great Lakes). Information provided for each habitat includes: detailed information on the habitat's structural and functional characteristics; techniques and parameters used to monitor restoration projects; discussion of anthropogenic impacts to habitats; and annotated bibliographies of monitoring protocols,

methods manuals, ecological monitoring and other literature relevant to restoration monitoring purposes. Each parameter listed in the manual is not expected to be monitored in every restoration project. Listed parameters were suggested by experts in the field or gleaned from literature searches and are offered as a starting point for practitioners to choose from depending on the project goals and available funding. Minimum standards have been indicated for restoration monitoring in order for a monitoring plan to be funded under The Estuary Act (ERA) of 2000.

#### **MEASURING POTENTIAL IMPACTS OF DREDGED MATERIAL DISPOSAL IN COASTAL SYSTEMS: WHO DECIDES?**

*Drew A. Carey, CoastalVision*

I examined several parallel but distinct processes of participatory decision-making in the selection of aquatic sites for dredged material disposal. In each case the management goals for aquatic resources and uses had to be balanced against needs of navigation-dependent industries. The regulatory framework for site selection and permitting of aquatic disposal of dredged material appears well entrenched. However, processes of local and regional governance actually create divergent approaches to decision-making. Despite the divergent decision-making, extensive networking and sharing of measurement and monitoring techniques has led to convergent solutions across the country. These convergent solutions are constrained by regional characteristics of aquatic systems (water depth, sediment type and contamination, and coastline) and the relative importance and concentration of navigation-dependent industries. In most cases, it is the distinctive local decision-making process that fits available solutions into regional opportunities. Measurements of direct and indirect impacts from historical disposal events are often used to predict potential impacts from proposed actions. A general model will be proposed for decision-making based on measurable outcomes within the framework of existing governance structures. Case studies in site selection are drawn from Long Island Sound, Narragansett Bay, Rhode Island Sound, Buzzards Bay, Boston, Salem and Gloucester, MA and contrasted with decisions made in San Francisco, Seattle, Long Beach and Galveston.

#### **MANAGEMENT TOOLS TO MINIMIZE IMPACTS OF RESIDENTIAL DOCKS AND PIERS**

*Allison Castellan, NOAA Coastal Programs Division, Steve Bliven, Bliven & Sternack*

To comprehensively manage docks, coastal managers must have both the latest science to support their decisions, and the laws and policies in place to implement new management techniques. This past November NOAA hosted a workshop to engage resource management professionals in promoting better dock and pier management tools. The workshop compiled and evaluated various regulatory, planning, design, and construction techniques that can be used to minimize the environmental impacts from small docks and piers. This talk presents the results of this workshop, describing the range of existing regulations and showcasing programs incorporating progressive and innovative management tools. As follow-up from the workshop, NOAA is developing a searchable, web-enabled database to house information on state regulatory and planning programs used to manage docks. The database will help managers improve and justify their regulations and permitting processes by providing examples of how other states handle similar circumstances. Information in the database can also be used to develop new standard operating procedures, support permit denials when the impacts of a proposed project are unreasonable, and develop dock management plans. The session will conclude with a discussion on regional outreach efforts to promote the information learned during the national workshop to a wider audience. This is one of three related talks on Integrating Science, Policy, and Management of Docks and Piers. Also see Assessing Environmental and Aesthetic Impacts of Docks and Piers (R. Kelty) and Visual Impact Assessment of Docks and Piers—Theory and Practice (S. Bliven) included in these proceedings.

#### **CREATION OF A BROWNFIELD REDEVELOPMENT SITE COMPENDIUM FOR DELAWARE COASTAL COMMUNITIES**

*Edmund J Cervone, Delaware Coastal Management Program*

Development activity within Delaware's coastal zone compromises the health of the coastal environment. The adverse effects of development are amplified by sprawl, the out-migration of people

from traditional urban settlements to surrounding undeveloped rural landscapes. Sprawl leads to environmental degradation and inefficient use of finite resources. Redevelopment of urban brownfields, underutilized properties with suspected contamination, can meet the needs of a growing population and maintain a healthy environment by eliminating the need to develop additional rural lands. The Delaware Coastal Management Program and the State of Delaware's Division of Air and Waste Management are creating a template for a brownfield redevelopment site compendium for Delaware coastal communities. The compendium will aid communities in marketing brownfields to developers. The compendium will be accessible in both digital web-based format and hard copy. At the core of the compendium will be a comprehensive brownfield site inventory and ArcGIS-based decision support system. These tools will provide technical information on site contamination, redevelopment potential, possible obstacles, and opportunities for assistance to developers. All information will be presented within the context of a community-based vision. The compendium is currently being developed for a pilot project in South Wilmington, Delaware. This project will be completed through a series of on-site investigations, community outreach meetings, and technical workshops. Workshops will be used to solicit thoughts on the design of the compendium from brownfield stakeholder workgroups. The final product will be presented to decision makers and managers in other Delaware communities.

### **THE ROLE OF COMPATIBILITY IN NATIONAL MARINE SANCTUARIES**

*Gib Chase, U.S. Fish & Wildlife Service*

The Marine Protection, Research, and Sanctuaries Act of 1972 states that multiple uses of national marine sanctuaries may be facilitated to the extent compatible with the primary objection of resource protection. The legislation contains no specific direction as to how or when determinations should be made or what critical elements are to be used to render such determinations. This lack of direction has led to virtually no control over recreational and commercial uses within individual sanctuaries and the national marine sanctuary system. The recent trend has been to apply zoning or to establish no take reserves within approved sanctuary boundaries. Both are quick fixes that undermine the principles of National Marine Sanctuary Program and its mission. The sacrifice of one or more habitat types outside a reserve boundary to unregulated, incompatible, destructive activities result in reduced biodiversity and associated reduction in ecological health and integrity of the sanctuary as a whole. This is in direct violation of NOAA's statutory directive to protect a sanctuary's habitat and biodiversity. By assuring uses within sanctuary boundaries are compatible with the purposes and mission of the sanctuary, the marine habitats within sanctuaries will be assured of protection. The public trust interest is served since these special areas will be functioning as productive marine areas for future generations. A compatibility policy and determinations process can help bring consistency to an otherwise ineffective and fragmented regulatory framework presently in place.

### **LEGISLATING COASTAL GOVERNANCE: TRENDS, PRACTICES AND STRATEGIES IN COASTAL LAW-MAKING**

*Aldo Chircop, World Maritime University*

Coastal law is a relatively new legal field straddling other areas of law, namely environmental, private (torts, property), public (constitutional, administrative, planning), natural resources (oil and gas, fisheries), maritime and international law (law of the sea). Since the 1980s numerous countries (including states or provinces in federal countries) have adopted dedicated statutes as framework and tools for national or local coastal management. These statutes frequently constitute attempts at integrated coastal law-making and deserve scrutiny as important tools for coastal management.

This paper is the result of a comparative law research project inventorying and analyzing coastal statutes and identifying trends in over forty countries. Statutes from different legal systems, including common law, civil law, socialist law and mixed legal systems are studied. The paper identifies trends in: (1) interpretation and implementation of integration; (2) application of the Rio principles of sustainable development; (3) the institutional framework for management, including lead roles and coordination; (4) degree of coordination with other statutes; (5) conflict management; (6) international issues, such as transboundary management matters with neighboring countries. The paper concludes with opportunities, constraints and options for legal strategies in support of integrated coastal management.



## **EVALUATING ALTERNATIVES FOR COASTAL DEVELOPMENT**

*Nancy Cofer-Shabica, PSGS at NOAA Coastal Services Center, Amanda Rutherford, PSGS at NOAA Coastal Services Center, Patricia McIntosh, The Georgia Conservancy, Fred Hay, Georgia Coastal Program*

Providing for residential growth, fostering economic development, and protecting natural resources of coastal lands requires a balance between the built and non-built environment. A variety of factors come into play, including land values, the abundance of natural resources, real estate market trends, local ordinances, and community character. Tools that allow communities to analyze and visualize how such factors may play out can help foster more informed local decision making for managing coastal development.

The "Alternatives for Coastal Development" Web site is one such tool, illustrating three hypothetical designs for a single development site in coastal Georgia. This recent NOAA Coastal Services Center project is designed to serve as an educational tool that state-level partners can share with local constituencies. Included are conventional, new urbanist, and conservation development scenarios for the project site and a comparative analysis of selected components of each scenario produced with geographic information system (GIS)-based planning and visualization software.

GIS maps and a triad of environmental, economic, and social indicators measure differences among the alternatives presented. The indicators allow users to consider the overall benefits and costs associated with selected components of the three site designs, while the maps and three-dimensional representations help users visualize the impacts of various design components. An indicator methodology is made available, allowing users to view the inputs, assumptions, and calculations for each measure.

## **TECHNICAL ADVANCEMENTS IN REGIONAL OCEAN GOVERNANCE**

*Kimberly Cohen, NOAA Coastal Services Center*

The Ocean Planning Information System (OPIS) has served as a model for regional ocean governance since September 2000. OPIS provides the coastal management community of the southeastern U.S. with access to regional georeferenced regulatory and environmental spatial data to enhance decision making. Although the data and information contained within OPIS are specific to the Southeast region of the U.S., the principles and methodologies on which the system is based are applicable nationwide and have since spurred similar projects in other regions. During the OPIS development process, governance-related issues received increased attention as questions arose regarding inconsistencies in marine boundary descriptions. Consequently, interagency working groups were established to address these concerns, formulate consistent methodologies, and assemble a best practices document that communicates this expertise to both the legislative and the technical communities to reduce the likelihood that such discrepancies will persist in the future. More recently, the U.S. Commission on Ocean Policy and the Pew Oceans Commission generated a renewed interest in and focus on ocean policy and governance issues at the national level. This increased awareness within the U.S. provided a unique opportunity to revisit the utility of the OPIS site and restructure its content to incorporate additional information regarding regional coordination, observational or monitoring systems, marine protected areas, and other issues that provide context for these governance questions. In addition, the incorporation of newer geospatial and Internet technologies has greatly expanded the types of data and mapping functionality that can be served within the OPIS on-line mapping application.

## **PANEL: WILDLIFE HABITAT CONSERVATION AND THE NATIONAL ESTUARY PROGRAM**

*Greg Colianni, EPA-Ocean & Coastal Protection Div.*

The National Estuary Program (NEP) was established in 1987 to identify, restore, and protect nationally significant estuaries of the United States. Unlike traditional, regulatory approaches to environmental protection, the NEP targets a broad range of issues and encourages communities to develop common solutions. Staff scientists, policy analysts, and outreach coordinators work with local communities to identify problems and create consensus-based actions to address problems facing their watersheds. The cornerstones of the NEP, drawn from predecessors such as the Chesapeake Bay Program, include a focus on watersheds as the basic environmental management unit, the integration of good science with sound

decision-making, a collaborative approach to problem solving, and the critical role of public participation. Wildlife habitat conservation is a priority issue for many NEPs, as coastal counties continue to be the fastest growing areas of the country and already contain over half the U.S. population. Growth has been accompanied by a substantial loss of important habitat in many regions. Various NEPs are employing innovative and successful methods to protect and restore vital habitat lost from development. To showcase some of these activities, a panel of NEP representatives from around the country will discuss ongoing efforts to assess the health of their estuaries and present useful strategies to manage important coastal resources. Topics will include developing and implementing successful monitoring programs, methods for identifying and protecting threatened systems, developing habitat restoration plans with measurable goals, defining and managing critical habitat, and discussing challenges associated with managing large natural systems.

#### **COASTAL COMMUNITY OUTREACH: A PRESCRIPTION FOR COMMUNITY CONNECTIVITY**

*Michael Leonard Crane, NOAA NCDDC*

The collection of individuals, organizations, governmental agencies, companies and institutions that comprise the coastal community can be encouraged to have a connected identity. Items of common interest and information of common need can be identified in a dynamic outreach approach called the Accelerated Coastal Community Environmental Science Service (ACCESS) methodology. Building a bond among a wide spectrum of community interests can be an effective collaborative tool for addressing coastal issues. Preserving coastal values can be a collaborative activity in place of an adversarial activity. Examining the structure and resources to address coastal issues is one of the first elements in the ACCESS methodology. Seeking team identity is the next step in the method. Delivering new functions is the metric for evaluating the success of the method.

#### **IMPLEMENTATION OF THE BROAD CREEK MANAGEMENT PLAN: HOW LOCAL GOVERNMENT CAN MAKE A DIFFERENCE**

*Karen M. Cullen, AICP, Town of Hilton Head Island, Teri Lewis, Town of Hilton Head Island, Ginger Martin, Town of Hilton Head Island*

The Town of Hilton Head Island spent two years researching and preparing a management plan for Broad Creek, a tidal river on the island. Town staff presented this plan at the TCS18 conference in 2002. We are now proposing to present a poster to provide an update on the activities the Town has engaged in toward implementation of the recommendations made in that plan.

The poster will include a brief summary of the plan and why we felt that a plan created by a local government was needed. Broad Creek is one of the most valuable and vulnerable natural resources on the island, and has been significantly impacted by development since the 1960's. The study was a comprehensive look at land use, water quality, recreational use and wildlife usage. Its aim was to identify actions that could be taken to reduce further degradation of the creek's ecosystem. As a local government with significant powers on land use decisions, we felt we are in an excellent position to initiate change.

Because the results of the study were presented in 2002, the majority of the poster will focus on the implementation strategies. We will include discussions of successful actions we have already taken, including how they have been received and what impact they have made. We will also include brief discussions on the issues we have faced in trying to implement several of the recommendations, and how we may be able to overcome problems we have encountered.

#### **STOMPING SUPERTRAMPS (AND OTHER AIS) IN THE DELAWARE ESTUARY**

*Shari Currey, Pennsylvania Sea Grant*

Across the United States, aquatic invasive species such as the zebra mussel, purple loosestrife and Eurasian watermilfoil are threatening natural biodiversity, water-based recreation and tourism, and even public health. These ecological and economic impacts threaten the vitality of the Delaware Estuary and the pace of new invasions will only accelerate without active prevention, public awareness and regional

coordination. As a result, the Delaware Estuary Office of Pennsylvania Sea Grant has identified aquatic invasive species as a primary topic for its education and outreach activities.

To better target these activities, Sea Grant staff surveyed resource managers throughout the Delaware Estuary region to determine which non-indigenous plant and animal species were of greatest concern. The results of this survey were used to compile a list of the “Top Ten Least Wanted Species” in the Delaware Estuary. In turn, this list was used to create Aquatic SuperTramps, a traveling, educational exhibit designed to raise public awareness of aquatic invasive species issues. Featuring species such as Asian carp, flathead catfish, nutria, Hydrilla, purple loosestrife and Eurasian watermilfoil, Aquatic SuperTramps provides valuable information about the introduction and transport of plants and animals that compromise the environmental integrity of the Delaware Estuary.

Respondents were also asked to comment on any research, outreach or management programs that their organizations have implemented to address aquatic invasive species issues. This information will assist Sea Grant staff as they facilitate the formation of a regional AIS task force and the development of a statewide AIS management plan.

## **DEVELOPMENT OF A GIS-BASED DATABASE OF COASTAL BLUFF EROSION AND ARMOR IN CALIFORNIA**

*Jennifer L. Dare, Mark J. Johnson, California Coastal Commission*

Coastal bluffs back large portions of the California coastline and most of these bluffs are actively eroding. This erosion threatens existing development and creates a coastal management challenge in regulating the development of existing legal bluff-top lots. To facilitate informed management decision-making, we are compiling all existing data on coastal bluff erosion rates and current coastal armoring in California into a GIS-based coastal management tool. Such a tool will enable policy makers to approach erosion on a regional basis. The identification of historical long-term erosion rates allows for informed policies. Analysis of short-term erosion events and their distribution allows better analysis of threats to existing development.

Erosion rate data sources include government studies, academic studies, peer-reviewed publications, and reports of private consultants. These disparate data vary in both collection methods and reliability. We currently are developing a set of criteria for weighing these data in terms of quality, time interval covered, and length of record. From these data, the GIS tool will allow the evaluation of both short- and long-term erosion on a statewide basis. When coupled with the layers describing existing coastal armor, this database can be queried to identify areas that may be susceptible to future armoring requests. By anticipating future requests before a crisis situation arises, more time is available to consider alternative methods of shoreline protection.

## **CASE STUDIES OF STATE-LEVEL MARINE MANAGED AREA SYSTEMS**

*Braxton Davis, Baruch Institute/University of South Carolina, John Lopez, Coastal States Organization*

State-level Marine Managed Area (MMA) systems exhibit a high level of complexity and diversity when compared with federal MMA policies and programs. For example, resource protections at the state level most often occur through multiple, single purpose overlay zones, rather than through comprehensive planning areas. In addition, the types of protections afforded marine resources at the state level differ significantly from those found at the federal level. States often protect nearshore marine habitats by regulating coastal developments and alterations, including dredging and filling operations, docks and marinas, and aquaculture facilities. This study provides a cross-case analysis of six MMA systems under state jurisdiction (in California, Oregon, Washington, Michigan, North Carolina, and Florida), and documents the lessons learned by state managers involved with their development and implementation.

In general, the MMA systems examined in this report gained strong stakeholder support due to two key factors: 1) the early, extensive, and inclusive nature of stakeholder participation in system planning; and 2) strong scientific data that supports site selections and boundary demarcations. Coordination between and among local, state, and federal agencies, often through new partnerships, was also considered essential to the success of these MMA systems. MMA systems that were established in the

1970s and 1980s were not as likely to have considered the concept of ecological networking. Newer systems are encountering difficulties with the science needed to plan for and/or demonstrate site connectivity. Finally, program evaluations were considered of low value in several cases; in others, significant constraints to evaluations were identified.

#### **DEVELOPING THE CAROLINAS COASTAL OCEAN OBSERVING AND PREDICTION SYSTEM (CARO-COOPS)**

*Braxton Davis, Baruch Institute/University of South Carolina, Madilyn Fletcher, USC/Baruch Institute, Len Pietrafesa, North Carolina State University, Marvin Moss, University of North Carolina/Wilmington, Earle Buckley, North Carolina State University*

The coastal ocean of North and South Carolina is one of the nation's most ecologically diverse and economically important systems. A need exists for real-time data and comprehensive information products on marine and coastal conditions in the region, but the present observational network of routine in situ data is inadequate for most applications. In addition, an improved understanding of how the coastal ocean has behaved in the past, and is likely to behave in the future, is essential to managing the region's ocean and coastal resources.

The "Carolinas Coastal Ocean Observing and Prediction System" (Caro-COOPS) was recently deployed through a partnership between the University of South Carolina, North Carolina State University, and University of North Carolina at Wilmington. This new observational array currently comprises three shore-based stations and nine offshore buoys, which provide a new foundation for integrated observations, data communications, management, and modeling of the Carolinas' coastal ocean. Caro-COOPS will continually strive to meet the information needs of a broad user-base that includes federal, state, and local coastal and ocean managers, industries, and stakeholders.

An initial demonstration of the real-time interdisciplinary forecasting capacity of Caro-COOPS is focusing on real-time predictions and analyses of storm surge and flooding before and during landfall of coastal storms. This product will provide local and state officials with information needed to improve mitigation, preparedness, and prevention measures. Caro-COOPS data will also be of use for future applications related to water quality and the transport of pollutants, sediment transport and shoreline stability, and fisheries management.

#### **NATIONAL PARK STEWARDSHIP AND 'VITAL SIGNS' MONITORING ON THE COAST**

*Gary E. Davis, US National Park Service*

The National Park System includes more than 70 coastal parks, seashores, lakeshores, and monuments along nearly 5,000 miles of ocean and Great Lakes shoreline. These sites protect 35 million acres of the nation's prime coastal habitat, including more than 3 million acres of submerged lands and waters. Place-based conservation strategies require that stewards know and understand the targeted ecosystems, restore impaired resources, protect the ecosystems, and connect people wholeheartedly to the places. These actions are the cornerstones of stewardship: know, restore, protect, and connect. Knowledge of ecosystem structure and functioning is first among equals in stewardship. Monitoring the ecological equivalent of medical 'vital signs' is the quickest, surest, and cheapest way to discover and track ecosystem dynamics. Monitoring ecological 'vital signs' can determine status and trends of ecosystem integrity and establish limits of normal variation. It can also provide early warnings of situations that require intervention, and help frame research questions to determine chains of cause and consequence. The power and probabilistic nature of biological interactions in ecosystems preclude effective use of deterministic modeling to predict ecosystem behavior. Therefore, ongoing monitoring is required to reliably increase knowledge of system dynamics. The National Park Service has begun to identify and monitor the ecological equivalent of medical 'vital signs' in 32 networks of 270 parks. Eleven of these networks are composed largely of coastal parks. The National Park Service seeks opportunities to partner with other agencies and institutions in the stewardship and monitoring of our coastal parks.

## **GUIDANCE FOR ASSESSING ECOLOGICAL FUNCTIONS TO INFORM LOCAL SHORELINE MANAGEMENT PLANS**

*Sophie De Beukelaer, Department of Ecology*

In December, 2003, Washington State adopted a new rule requiring city and county governments to update their shoreline master plans (SMP) to ensure “no net loss of shoreline ecological functions.” To do this, local planners need technical guidance to complete applicable shoreline inventory and assessments. We are developing guidance that integrates the most current scientific findings to determine the health of ecological functions. We begin with specific recommendations on how to extract relevant information from existing data and technical reports. Geographical Information Systems (GIS) projects are created to help assess the relationships between ecosystem wide processes and ecological functions within shoreline jurisdiction. The guidance provides illustrated case examples of lake, river, and marine shoreline assessments with GIS created maps and images. After identifying the primary driving ecosystem wide processes, we suggest dividing the shoreline into reaches based on geomorphology. Biological and shoreline modification data layers are then overlain and a summary of the ecological functions may be inferred by addressing a series of questions regarding the position of mapped features relative to the source, transport and response zones of the reach. Ultimately, opportunity areas for protection and restoration are mapped and described. Providing shoreline planners with technical guidance assists local governments in achieving a state regulatory requirement. More importantly, it results in scientifically informed local shoreline master plans that minimize loss of shoreline ecological functions.

## **PERFORMANCE CRITERIA TO MEASURE ECOSYSTEM-BASED MANAGEMENT IN THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM**

*Michael P. De Luca, Institute of Marine & Coastal Sciences*

Criteria to measure results of science-based management efforts in the National Estuarine Research Reserve System (NERRS) are being developed. Such criteria must enable coastal decision-makers to determine whether management efforts provide adequate protection for key land and water areas, and whether training programs support informed decisions at local scales. This requires metrics that extend beyond simple parameters such as acres of wetlands preserved, numbers of permits issued or denied, or training in “best management practices.” For example, the Coastal Training Program established by the NERRS aims to empower coastal managers with science-based information and technology to inform local environmental management. Merely counting the number of individuals that received training does not indicate whether the training has led to implementation of new management strategies. Criteria that measure revision of local master plans may be a more useful measure of program success.

Experience of reserve staff with evaluation of educational programs is expected to assist development of useful performance criteria for tracking change in habitat and water quality. Of particular interest are the concept strands that reserve staff is using to measure effectiveness of science-based teacher enrichment programs. This approach, along with other emerging performance criteria will be presented for discussion. Coordination of performance-based monitoring programs among the NERRS and the National Estuary Program also will be discussed.

## **MAPPING THE FUTURE OF MAINE’S BEACHES AND BIRDS**

*Stephen M. Dickson, Maine Geological Survey, Peter A. Slovinsky, Maine Geological Survey, Kristen Whiting-Grant, Maine Sea Grant*

Maine’s Coastal Sand Dune Rules define an erosion hazard area (EHA) as any portion of the coastal sand dune system that can reasonably be expected to become part of a coastal wetland in the next 100 years due to cumulative and collective changes in the shoreline from: (1) historical long-term erosion; (2) short-term erosion resulting from a 100-year storm; or (3) a 100-year flood after a two-foot rise in sea level. The rules also state that structures, such as seawalls, cannot be used to demonstrate stability over 100 years.

The Maine Geological Survey is delineating EHAs along Maine’s sandy shoreline in support of this definition. Short-term erosion is determined using a combination of monthly beach profiles collected by the volunteer-based Maine Beach Profiling Program, LIDAR data, GPS surveys, and aerial photography

following the 1991 Halloween Storm. Long-term erosion is determined by digitizing the seaward edge of frontal dune vegetation or, in its absence, structures such as seawalls in orthorectified aerial photographs. However, seawalls have postponed erosion, resulted in beach profiles of disequilibrium, and precluded conventional horizontal erosion rate calculations. To overcome this latter problem, shoreline change along stabilized beaches is being estimated by projecting 'natural' beach and dune profiles landward of seawalls to estimate the shoreline and dune position that would exist in the absence of a seawall. The position and age of the seawall is used as a shoreline proxy for long-term erosion rate calculations. Together these data will be incorporated into 100-year EHA maps for coastal management.

#### **USING GIS TO EVALUATE COMPLIANCE WITH DEPARTMENT OF NATURAL RESOURCES PERMIT CONDITIONS ALONG MINNESOTA'S NORTH SHORE OF LAKE SUPERIOR**

*David Easter, Clinton Little, MN's Lake Superior Coastal Program*

Minnesota's North Shore of Lake Superior has experienced increases in the conversion of undeveloped forested lands to residential housing, resulting in greater land disturbances that may degrade water quality in streams and lakes. The North Shore is characterized by clay soils over bedrock with areas of steep topography, making local streams and rivers susceptible to silt and sediment loading when disturbed. The Department of Natural Resources (DNR) is responsible for regulating activities that occur within state waters.

DNR permits may be conditional to ensure consistency with state laws and policies. Monitoring projects for compliance with permit conditions, however, has been problematic. The question is not if the laws are adequate, but whether they are effective. The DNR has initiated a project to evaluate compliance with permit conditions and to assess the effectiveness of the permitting process.

The first step in this project was to create an Access database linked to ArcView GIS for storing, viewing, and manipulating permit information, including scanned permit documents. This system allows the hydrologists to view and query past permit data in tabular and spatial form, is mobile for site visits, provides access to a strong collection of GIS data layers, interfaces with a GPS, and provides all available permit documentation. This database will form the foundation for answering questions about the permit process and provide for further analysis of cumulative effects from development along the North Shore.

#### **LUXURY ENVIRONMENTS & SUSTAINABLE TOURISM: RESPONSIBLE SITING, DESIGN & DEVELOPMENT OF DESTINATION RESORTS IN THE COASTAL ZONE**

*Becky Ellis, University of Washington, SMA / JSIS*

Perhaps the greatest impact to the environment when constructing a building occurs upon selection of and manipulation of the site. Understanding a site's potential and constraints facilitates responsible siting location, site design, and building design so as to ensure the least environmental impact. For example, extensive reshaping of the coastline and natural landscape should be avoided both to reduce costs associated with extensive site work and to integrate with local, natural and built aesthetics. Utilization of natural coastal systems reduces investment in ground maintenance of environmental controls and energy. Existing site geomorphology can give clear indicators for patterns of erosion and zoning schemes for relationships between built and natural environments can enhance features such as biodiversity, drainage, water quality, slope stability and natural vegetation.

"Coastal tourism" evokes images of resorts at the seaside with white sandy beaches lined with coconut palms and crystal-clear waters, laden with concepts of luxury and opulence. Design of resort themes and building architecture affect interaction patterns with local natural and social environments, as well as the aesthetic and local traditions of the coastal site context. Building capacity for sustainably managing the resources and culture associated with these images requires commitments from each component of the tourism model—brokers, locals, and tourists. This study seeks to provide a framework by which the resort development process, although only one component of sustainable tourism development in the coastal zone, can have huge impact in greatly reducing the destructive footprints of the built environment for multiple uses and users.

## **COASTAL MANAGER PERCEPTIONS OF NORTH CAROLINA BEACH VISITOR EXPERIENCES**

*Chris Ellis, East Carolina University*

Experiencing diversity is an important factor in people's coastal recreation and leisure pursuits. It is plausible that coastal management agencies are largely responsible for determining the recreational composition of a beach visitor's experience through site-specific rules and regulations that govern these areas. Considering the abundance and diversity of North Carolina beach areas, why do beach visitors go where they go? More specifically, do agency policies and regulations influence the beaches visited by coastal tourists? In these times of dwindling public access and natural resource depletion, it is of critical importance that environmental planners and coastal resource managers be aware of what types of settings are most appealing to coastal recreationalists so they can adequately address problems of both underutilized and high use beach areas.

To gain an understanding of the policies and regulations that affect coastal tourism, a survey of North Carolina coastal managers was conducted. The survey was administered to managers at seven predetermined beach locations. These areas represent the various jurisdictions that manage the North Carolina coast. Agencies include federal, state, and municipal (city/county) government agencies. Questions were designed to demonstrate the full diversity of potential beach experiences. They include variables of visitor activity interests, social preferences, perceptions of environmental quality, and perceived management quality. Discussion focuses on how managers perceive the above variables impact the experience of their beach visitors.

## **COMPLYING WITH THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PHASE II STORM WATER REGULATIONS: NAVAL STATION NEWPORT STORM DRAIN OUTFALL MAPPING NEWPORT, RHODE ISLAND**

*Laura M. Ernst, ESS Group, Inc., Cornelia A. Mueller, Naval Station Newport, Karen Hanecak, ESS Group, Inc.*

The United States Environmental Protection Agency (USEPA) has determined that municipal separate storm sewer systems (MS4s) are a major pathway for the introduction of pollutants to waterways and are a leading cause of the impairment of ambient water quality, for both fresh and coastal waters. The USEPA has developed regulations governing storm water for MS4s in 40 CFR Part 122. The Rhode Island Department of Environmental Management (RIDEM) has written equivalent regulations in its Regulations for the Rhode Island Pollutant Discharge Elimination System. MS4s are required to develop, submit for RIDEM approval, and ultimately implement a Storm Water Management Plan (SWMP) that addresses six minimum control measures. ESS Group, Inc. performed storm drain outfall mapping for the Naval Station Newport to comply with the Naval Station's Phase II SWMP Illicit Discharge Detection and Elimination program.

ESS personnel used a handheld Global Positioning System unit with 3 feet accuracy to obtain coordinates for outfalls to Narragansett Bay. With the coordinate locations, ESS then developed a Geographic Information System map that includes the storm drain outfalls overlaid on geographic referenced orthophotographs. An interactive ArcView database was created as part of the GIS project which includes details on the storm drain outfall including type and size of pipe, presence/absence of flow, and date of inspection. The database will allow Naval Station Newport to easily track the condition and maintenance of storm water structures, record and track illicit discharges, record sampling data and identify trends and changes in water quality over time.

## **MARINE AND COASTAL PROTECTED AREAS IN THE U.S. GULF OF MAINE REGION**

*Susan Farady, Cheri Recchia, The Ocean Conservancy*

The Ocean Conservancy mapped and evaluated the marine and coastal protected areas in the U.S. Gulf of Maine region (results published in a 2001 full-color report and companion poster). Over 300 sites in the U.S. portion of the Gulf, its coastal drainage area, and Georges Bank were analyzed. The full-color report and poster illustrate the results and recommend several actions.

The protected areas were analyzed in three ways to indirectly evaluate how effectively the sites conserve marine species, habitats and ecological processes. First, protected areas with marine components were evaluated against the Protected Area Management Categories developed by the IUCN - The World Conservation Union. Second, the areas were assessed for measures implemented within to limit or prohibit specific activities (such as alteration of shorelines and coastal habitats, non-renewable resource development and disturbance of benthic habitats). Finally, sites were rated for their value in long-term conservation of marine biodiversity using a scoring system based on permanence of designation, size, and type, level and seasonality of protections provided.

All three analyses demonstrated that existing marine and coastal protected areas provide some important protections for endangered species and reduce the impacts of human activities on species and habitats. However, very few sites are designed or managed to provide comprehensive, lasting protection to the full range of marine species and habitats. The strongest protections are concentrated in small, scattered coastal sites, and the vast majority of Gulf of Maine waters lack protected areas of any kind.

### **IMPLEMENTING NO NET LOSS FOR WASHINGTON STATE SHORELINE MANAGEMENT**

*Stacy Fawell, University of Washington*

One of the most significant changes to the recently updated Shoreline Management Guidelines of Washington State is the requirement for local Shoreline Master Programs to place a greater reliance on a policy of “no net loss of shoreline ecological function.” The new guidelines direct local governments to ensure no net loss by including policies and regulations for mitigation of ecological function impaired through development otherwise allowed by the Program. However, if current compensatory mitigation practices are not successful at replacing ecological function, local planners may not succeed in meeting this policy goal if their permitting process relies strongly on requiring mitigation for environmental protection. To provide direction to local governments on the degree of mitigation to allow in working to meet the “no net loss” policy, I have performed a literature review to assess the understanding of mitigation effectiveness, the success of other no net loss policies, and how shoreline functions are defined. These results will be used to inform a policy analysis to examine how different degrees of mitigation allowed through local Programs can meet the objectives of the Shoreline Management Act. Preliminary results from the literature on wetland mitigation show a less than 50% compliance rate with permit requirements, a net loss of wetland acreage and failure or inconclusive results on the replacement of function. Based on these initial findings, I predict that policy at the state and local levels should place a strong reliance on avoidance and minimization of impacts to shoreline ecological function.

### **SCIENCE TRANSLATION FOR NON-POINT SOURCE POLLUTION CONTROL-A CULTURAL MODELS APPROACH WITH MUNICIPAL OFFICIALS**

*Christine Feurt, Wells NERR and Antioch New England*

Environmental research that identifies and documents the scope, causes and consequences of degradation of coastal and estuarine resources must be translated to decision makers, resource management agencies and the public in ways that are understandable and useful. The practical application of scientific information can be hindered by lack of understanding by users unfamiliar with scientific information and complex technologies. The Coastal Training Program (CTP) of the National Estuarine Research Reserve (NERR) system has been developed to provide science based information and training to decision makers in ways that promote wise stewardship of coastal resources.

Water quality, pollution and storm water management are key training themes identified through a needs assessment of coastal decision makers served by the Wells NERR CTP. Municipal officials have been identified as the priority audience for this training. This paper presents the results of research designed to assess the ecological knowledge, beliefs and values of municipal officials in southern Maine about water pollution; the connections between land use and water quality, and the role of science in decision making. Ethnographic and social science methods are used to determine the cultural models of municipal officials relevant to non-point source pollution and to compare lay knowledge with an expert model of non-point source pollution. Knowledge of the resultant cultural models will be used to design and evaluate water quality related training and outreach materials to coastal decision makers. The applicability of this method to enhance the effectiveness of CTP across the NERR system will be assessed.



## **MAPPING SOCIAL CHANGE IN U.S. COASTAL COUNTIES: A SOCIAL ATLAS OF COASTAL NORTH CAROLINA**

*Thomas E. Fish, NOAA Coastal Services Center, Rhonda C. Crawley, Perot Systems Government Services, Jack F Thigpen, North Carolina Sea Grant Program*

Coastal areas across the United States are changing, both in terms of their natural and cultural environments. The people that live and work in coastal communities are struggling to adapt and survive amidst such changes. At national, regional, state, and local levels, policy makers and resource management agencies are challenged with developing programs, regulations, and incentives to optimize the coast's human, economic, and environmental well being. To accomplish these tasks, decision makers need information about past and present conditions, changes over time, potential future conditions, and implications of social change to quality of life.

This presentation describes a project to examine social change in 20 North Carolina coastal counties. The project uses the "human ecosystem" model as an organizing concept for assessing changes related to population, demographics, housing, socioeconomics, natural resources, and land use in coastal counties across time and space. Data was compiled in a geographic information system (GIS) to analyze and depict static past and present conditions and changes over the past 30 years for select social indicators. The final product consists of a social atlas for North Carolina coastal counties, which includes descriptions of social indicators, maps of conditions for 1970, 1980, 1990, 2000, and changes from 1970 to 2000, case studies illustrating changes in select coastal communities, and a CD-ROM with data resources and a catalog of digital social change maps.

## **BALANCING VISITOR USE WITH RESOURCE PROTECTION IN COASTAL AND MARINE PROTECTED AREAS**

*Thomas E. Fish, NOAA Coastal Services Center, Theresa G. Coble, Arthur Temple College of Forestry*

Most of the world's population lives within the coastal zone. In the contiguous United States, this represents more than half of the population; yet an estimated 99 percent of the U.S. public relies on the provision of public (or private) access to the coast. Growing demand and participation in outdoor leisure activities and advancement in recreation equipment technologies create increased pressure to coastal and marine ecosystems and their representative protected areas. As more people choose to live, work, and play along our nation's coasts, coastal and marine resource management professionals are challenged with balancing the changing demands of the public with the management of the resources under their care. Success in this delicate balancing act is aided by the use of consistent, systematic, collaborative decision-making tools. In the absence of such tools, management decisions surrounding visitor use are often fragmented, reactionary, and less defensible.

This presentation describes efforts from a series of training workshops conducted to equip coastal resource management professionals with a process to identify, plan for, manage, and monitor, visitor use and its associated biophysical and social impacts. The workshops are offered on a request basis and have, to date, been offered in eight coastal states. Initial impetus for the workshops came from needs expressed by the coastal management community. Additional impetus came from the recent redevelopment of a visitor use management handbook that presents visitor use planning frameworks and management methods, originally developed for terrestrial protected areas (e.g., national parks, national forests), in a coastal environment context.

## **WORKSHOP: SOCIAL ASSESSMENT CONCEPTS AND APPLICATIONS FOR COASTAL MANAGEMENT**

*Thomas E. Fish, NOAA Coastal Services Center, Rhonda H. Crawley, Perot Systems Government Services, Jack F. Thigpen, North Carolina Sea Grant Program*

This workshop provides an overview of the concept, practice, and application of social assessment for natural resource management, particularly as it applies to coastal and marine protected areas and associated communities. Social assessment is a systematic means of data collection and analysis that employs a variety of social science methods to generate information about the social and environmental structure, social processes, and relevant social changes within a given community, region, or other geographic extent. A social assessment can provide information about how a community is organized, how its people relate to one another, how people use and relate to natural resources, how decisions are made, and how the social environment has changed over time. Unlike traditional social impact assessments, used to forecast social impacts of specific management actions or regulations, social assessments encompass a broad range of social aspects and serve as a means to characterize the social environment within which one manages.

The workshop presents a “human ecosystem” approach for examining and understanding reciprocal relationships between human activities and the natural resources that sustain them. The human ecosystem can be used as an organizing framework in social assessments to identify critical resources and social processes; determine appropriate scales of assessment; make decisions about data collection and analysis methods and post-assessment communication based on existing and future management needs. The format includes presentations, discussion, and small group exercises to identify and prioritize key elements necessary for planning and conducting a social assessment for an actual coastal management scenario.

#### **WAI OPAE TIDEPOLS MARINE LIFE CONSERVATION DISTRICT: A COLLABORATIVE APPROACH TO COASTAL GOVERNANCE AND HABITAT AND ECOSYSTEM-BASED MANAGEMENT**

*Linda Shea Flanders, RCUH/Division of Aquatic Resources*

Collaborative Coastal Governance included years of discussions between the Division of Aquatic Resources (DAR), tide pool users, and the adjacent community to reverse the decline in fish and invertebrates. Wai Opaе Tidepools Marine Life Conservation District (MLCD) became effective in June, 2003 to protect, conserve, and improve the unique marine resources.

Habitat and Ecosystem-Based Management occurs because the rules prohibit all harvest of marine life, except traditional and customary rights, and all commercial activities in contrast to species-based regulations.

DAR’s monitoring of coral, fish, and mobile invertebrates began before the MLCD and will continue, if funding allows, to evaluate the MLCD’s effectiveness. DAR mapped benthic habitat and fragility, supervised monitoring of human use by activity type, and documented frequency and type of substrate contact by MLCD users to develop an implementation strategy. In a community-driven initiative, additional monitoring of coral, fish, mobile invertebrates, human use, algae and water quality occurred.

Data collection within MLCD and adjacent similar habitat (control) followed standard protocols, where available, to maximize comparability between marine protected areas. Documentation of human use was more specific regarding fishing. Benthic habitats were mapped using NOAA’s categories, but at a finer resolution. Fragility was based on habitat type, water depth and coral species. Data will be used to develop a MLCD implementation strategy and a guidebook of methods that communities can use to help DAR manage marine protected areas.

#### **PUBLIC ACCESS TO COASTAL ENVIRONMENTS (PACE): PUBLIC ACCESS DATABASE DEVELOPMENT AND WEB SITE DESIGN PROJECT**

*Susan Fox, CT-DEP Office of Long Island Sound Programs*

The Office of Long Island Sound Programs (OLISP) of the Connecticut Department of Environmental Protection (DEP), seeks to collect, organize, analyze, and share information related to public access through the Public Access to Coastal Environments (PACE) Project.

The PACE Project will enhance the public’s use and enjoyment of Connecticut’s coast and will develop the following resources:

- A comprehensive GIS project and ACCESS database comprised of the current coastal access sites.
- A coastal recreation needs survey and a GIS project plus ACCESS database of coastal properties capable of meeting those recreational needs.

- An interactive web guide allowing the public to search and identify those coastal access sites available for a particular activity in a specified region. (This will be created, in part, from the current paper map The Connecticut Coastal Access Guide developed by the DEP.)
- A coastal land assessment of existing shoreline ownership in Connecticut comprised of a GIS component, MS ACCESS database and a screening protocol.
- Connecticut's Coastal and Estuarine Land Conservation Program (CELCP) plan, based on identified key coastal conservation needs and values that are best met or protected through coastal land acquisition.

The PACE Project will improve OLISP's ability to provide new and enhance existing coastal access opportunities by improving the understanding of existing shoreline ownership, developing a mechanism for prioritizing coastal properties for public acquisition, increasing the public's use of the Coastal Access Guide, and filling critical data gaps regarding existing but underutilized public access sites.

### **STRUCTURAL SHORELINE PROTECTION: PRIVATE PROPERTY VS. PUBLIC RESOURCES**

*Janet Freedman, RI Coastal Resources Management Council, Carolyn Box, University of Rhode Island*

The RI Coastal Resources Management Council regulates the construction of shoreline protection facilities along the Rhode Island shoreline. New structures are prohibited on shorelines adjacent to waters classified as Type 1 (conservation areas) in the Coastal Resources Management Program. They are allowed on shorelines adjacent to waters classified as Type 2 (low intensity boating) through Type 6 (industrial waterfronts). Pre-existing structures can be maintained regardless of water type. On urban shorelines that are prone to erosion, such as Greenwich Bay, RI, much of the shoreline is armored with structures that pre-date the management program. Most of these structures are eligible for maintenance permits.

Erosion and sea level rise have altered the shoreline since the initial construction of the majority of the shoreline protection structures surrounding Greenwich Bay. Structures that may have allowed lateral shoreline access in the past now restrict the public's use of the shore. A field reconnaissance survey was initiated in the fall of 2003 to (1) access the extent and condition of shoreline structures around Greenwich Bay, (2) assess the extent of public access limitations due to shoreline protection structures, and (3) to project the limits to shoreline access in the future when considering sea level rise and shoreline change. The goal of the project is to access areas where public access is most valuable and to explore prohibitions to structural alterations in these areas as part of the Greenwich Bay Special Area Management Plan.

### **MEASURING DOMINANCE AMONG CO-OCCURRING PLANTS**

*Christin B. Frieswyk, Joy B. Zedler, University of Wisconsin - Madison, Carol A. Johnston, South Dakota State University*

The dynamic nature of coastal wetlands makes the assessment of wetland condition difficult. The behavior of dominant species could give useful information about the condition of a coastal wetland. We created a dominance index that uses easily attained data on presence and cover to quantify dominance and differentiate among the forms of dominance. We then applied the dominance index to wetland vegetation data collected throughout Great Lakes coastal wetlands in conjunction with the Great Lakes Environmental Indicator project. Cattail (*Typha spp.*) was the most frequently dominant species and exhibited predominantly one dominance form. Other species, however, showed variation in dominance form among wetlands. Measures of anthropogenic stress were related to dominance forms. The forms of dominance and dominance index provide a practical and useful framework for the consideration of dominance as a trait that integrates species identity, environmental conditions, and geographical location.

### **THE DRAGON RUN: WATERSHED MANAGEMENT ACROSS JURISDICTIONAL BOUNDARIES IN VIRGINIA'S MIDDLE PENINSULA**

*David Fuss, Middle Peninsula Planning District Comm.*

As one of the Chesapeake Bay watershed's most pristine waterways, the Dragon Run harbors some of the most extensive and unspoiled swamp forest and woodland communities in Virginia. Yet, change in

land ownership threatens to fragment productive farm and forestland and natural habitat. Designed to proactively preserve the Dragon Run watershed's traditional land uses and its unique natural resources, the Dragon Run Special Area Management Plan is a collaborative effort between the Middle Peninsula Planning District Commission's Dragon Run Steering Committee and the Virginia Coastal Program.

A comprehensive watershed management plan involving four counties has been produced through the efforts of local, state, and federal governments, landowners and citizens, business and industry, educators, and conservation organizations. Plan implementation should include coordinated land use policies, programs that support forestry and farming, and managed public access. The momentum generated by this watershed management planning process has served to address coastal land use policies, sustainable economic development, watershed education, land conservation, public access, and invasive species control. Long-term funding has provided the stability necessary to carry out this time-consuming process that balances the differences of opinion on how to address the threat to the watershed and the common ground that defines the community's vision for the future of the watershed.

### **CHALLENGES AND OPPORTUNITIES FOR THE MAKAH TRIBE AND OLYMPIC COAST NATIONAL MARINE SANCTUARY**

*George Galasso, NOAA Olympic Coast NMS, Vincent Cooke, Makah Tribe*

The Makah Nation is a self-governing treaty tribe, with co-management responsibility for natural resources within their usual and accustomed fishing areas. The Olympic Coast National Marine Sanctuary (Sanctuary) is a nationally designated marine protected area, whose boundaries overlap with the Makah's usual and accustomed fishing area. The Makah supported the Sanctuary's designation in 1994 as a means to protect their resources from the threats of oil spills and offshore drilling.

Since designation, the Makah and the Sanctuary have worked on a number of projects of mutual interest; however, there have also been some uncertainty on how to proceed on certain initiatives and the proper way to conduct government-to-government consultations. When the Sanctuary was designated an advisory council was established, membership included seats for each of the four treaty tribes adjacent to the Sanctuary, as well as other agencies and non-governmental interest groups. While this was not the only means of communicating with the tribes, discussing issues of importance to the tribes in this venue without previously discussing them in a government-to-government setting caused some difficulties.

The authors will share some lessons learned and make recommendations on how the Sanctuary and the Tribe can have an appropriate and meaningful dialogue during the Sanctuary's upcoming management plan review. These views are those of the authors and not the Tribe or the Sanctuary.

### **RESULTS OF HEALTH SURVEYS IN TWENTY WESTERN ATLANTIC REEF AREAS**

*Robert N. Ginsburg, UM - Rosenstiel School, Philip Kramer, The Nature Conservancy, Judith C. Lang*

This Report presents highlights of results of twenty assessments of condition of corals, fish and algae made at 302 sites on Western Atlantic reefs between 1997 and 2000. Trained divers made the assessments using the well-established AGRRA protocols (<http://coral.aoml.noaa.gov/agra>). The twenty assessments are from the Bahamian Archipelago (4), Gulf of Mexico (2), Brazil (1), western Caribbean (4), central Caribbean (2), southern Caribbean and (4) eastern Caribbean (3).

- Remote reefs show as much evidence of reef degradation as reefs adjacent to populated and/or developed coastal areas.
- Mean live coral cover of all 20 areas is 26% for reefs at depths of 5-25 m. Recent partial-colony mortality of corals that are  $\geq 25$  cm is less than 4 %, and average total mortality (including completely dead) colonies is 28%.
- Bleaching and diseased-induced mortality from the 1998 ENSO event were most conspicuous in the western Caribbean and Bahamas.
- Acanthurids and scarids predominate on all reefs; seranids are less than 1% of fish on shallow reefs and 4% on deeper reefs.
- The small numbers of sightings for larger-bodied groupers and snappers ( $< 1/100$  m<sup>2</sup>) suggest the entire region is over-fished for many of these more heavily targeted species.

- Herbivore density (or biomass) and macroalgal index (a proxy for macroalgal biomass) are not correlated at the scale of the entire region.

The analysis of 300 additional sites is underway; with these, the AGRRA Database will allow for multi-scale comparisons across the entire region and provide a standardized baseline against which to evaluate major changes through future revisits.

**STUDY OF THE H.M.S. SANTA MONICA AND SURROUNDING SITES TO EXAMINE  
BIOCOMPLEXITY AT A SHIPWRECK SITE FOR THE PURPOSES OF DEVELOPING LONG-TERM  
MONITORING STRATEGIES AT SUBMERGED CULTURAL SITES**

*Kelly Gleason, East Carolina University*

Hundreds of historically significant shipwrecks lie in coral reef environments around the world. However, aesthetical and/or ecological implications of wrecks in these ecosystems are rarely monitored. Concreted wooden frames from a shipwreck on the seafloor may have significance beyond the cultural importance of a nautical archaeological site. Likewise, twisted pieces of metal might convey the image of a recycling yard though these same pieces might increase the number of hiding holes for particular species of fish, or increase the area available for colonization by benthic species. For submerged cultural resource managers, the value of understanding the relationship between the shipwreck site and its environment is a critical step in narrowing the gap that exists between the management of cultural and natural resources that often lie within the same jurisdiction and hold potential for interdisciplinary cooperation and monitoring. The H.M.S. Santa Monica remains remarkably intact in about 10 meters of water off the East End of St. John. Working in cooperation with the United States Virgin Islands Department of Planning and Natural Resources, the remains of the H.M.S. Santa Monica provide an ideal opportunity to study the impact of shipwrecks on reef habitats, and the ability of reef areas to recuperate from a wreck after 225 years. The opportunity to examine submerged cultural sites relative to their impacts and significance to the environment they lie in will have implications for long-term monitoring and future study of shipwreck sites in similar coralline environments.

**SOCIAL SCIENCE TOOLS AND METHODS FOR MARINE PROTECTED AREA MANAGEMENT**

*Hansje Gold-Krueck, PSGS/ NOAA Coastal Services Center, Quincy Pence, U.S. Fish and Wildlife Service, Thomas Fish, NOAA Coastal Services Center*

In 2000, the National Marine Protected Area (MPA) Center's Training and Technical Assistance Institute conducted a needs assessment of MPA managers. One finding that came out of this assessment was that managers need knowledge, access to research, and training on a variety of social science variables as they relate to MPAs. The "Social Science Tools and Methods for MPA Management" website was created to help address this need.

The website is designed to provide an overview of the social sciences to help familiarize MPA managers and staff members with social science concepts, methods, and tools as they apply to MPAs. The information on the website is meant to serve as a guide for coastal and marine management professionals when they are determining what projects to undertake, planning social science projects, and reviewing social science research.

The site features six theme areas identified by the National MPA Center's Social Science Research Strategy: use patterns; submerged cultural resources; attitudes, perceptions and beliefs; governments, institutions and processes; communities; and economics. The user is guided to relevant social science methods and tools, as well as case studies that illustrate how these methods and tools have been used effectively in MPA management.

The purpose of this presentation is to discuss the importance of social science in MPA management and how the "Social Science Tools and Methods for MPA Management" website can help managers incorporate social science into their MPA work.

**DIFFUSION OF INNOVATIONS IN COASTAL MANAGEMENT**

*James W Good, College of Oceanic & Atmospheric Science*

How do coastal managers learn about and apply innovative and successful processes, practices, and tools for coastal problem solving? And how can the governmental and nongovernmental organizations that support them be more responsive in providing that information in useful forms and assisting in its adaptation to local situations and needs? These questions were the focus of a recent study conducted by the Heinz Center, a Washington, DC-based environmental policy organization. The Heinz Centers report “Innovation by Design” was prepared by an eleven member committee representing government, academia, industry, and environmental organizations, and supported by Center staff (THC 2004). The author chaired the committee, but the report on which this paper is based was written collectively.

**TECHNIQUES FOR RAPID ASSESSMENT OF POPULATION DENSITY AND BODY SIZE OF THE LAND CRAB *CARDISOMA GUANHUMI* (LATTREILLE, 1825) IN PUERTO RICO**

*Yogani Govender, University of Puerto Rico, Concepción Rodríguez-Fourquet, University of Puerto Rico*

Crab population status inferred from fisheries statistics of the Department of Natural and Environmental Resources in Puerto Rico indicate declining numbers for the land crab *Cardisoma guanhumi* since the 1960's (Matos, 1999). Available information for this species in Puerto Rico has focused only on its biology and economic importance (Feliciano, 1962). In order to determine the status of *C. guanhumi* populations in Puerto Rico, a rapid assessment technique was required. In this study we compared two techniques, burrow count method and trapping methods in order to assess the potential of burrow counts as a reliable rapid assessment technique for estimating population density. Furthermore, we investigated the relationship between burrow width and biometric variables (carapace width, carapace length, crab weight, and pellet width) to determine population structure of *C. guanhumi*. Within six sites 112 crabs were trapped and 108 burrows counted, population estimates were 0.19 crabs / m<sup>2</sup> and 0.18 burrows/ m<sup>2</sup> respectively. Our results showed no significant difference in estimating population size using the different sampling methods. Size class distribution using carapace width and burrow width was unimodal, dominated by individuals of size class 50-60 mm for both methods used. There was no significant difference in determining crab size using carapace width and burrow width. We showed that burrow count method and burrow width measurements provide sufficient information about the population size and structure to be useful for resource managers and biologist interested in monitoring *C. guanhumi* populations in Puerto Rico.

**TRANSFORMING CORAL REEF CONSERVATION: USING RESILIENCE TO STAY ON THE FACE OF THE WAVE**

*Nina P. Hadley, The Nature Conservancy, Rob Salm, Elizabeth McLeod*

The Nature Conservancy, working closely with a wide range of partners both internationally and in the US, has created a vision for tropical marine conservation that enhances the prospect of recovery and survival for coral reefs in the face of growing local and global stresses, especially stresses associated with elevated sea surface temperatures and coral bleaching. This includes establishing networks of well-managed and financially-secure mutually replenishing MPAs. Recent work has focused on looking for patterns in the seas that bolster the ability of coral reefs and other tropical marine life to survive. Some reef areas do not bleach when others do, and some corals recover quickly when others die. Stocks of many reef fishes are replenished through spawning aggregations, large and predictable gatherings of reproducing fish. Identifying and protecting these important areas - and connecting them with others more vulnerable to local and global threats - is key. This model for designating and managing coral reef MPAs for resilience was endorsed at the World Park's Congress; work is underway in Palau, the Meso-American Reef, both highlighted in this paper, and in the Banda Flores Sea and in the Florida Keys, among other locations, to turn these principles into practice.

**THE ENVIRONMENTAL PROTECTION AGENCY'S ROLE IN PRESERVING AND PROTECTING COASTAL LANDS AND WATERS THROUGH THE NATIONAL ESTUARY PROGRAM.**

*Joseph Newton Hall II, Environmental Protection Agency*

The National Estuary Program was instituted in 1987. It represented a very different approach to solving coastal environmental problems. The regulatory approach had been adapted in the earlier years of the Agency. The new approach brought all of the stakeholders to the table, first to clearly identify and characterize the issues and the environmental problems. Working through a conference structure and ensuring the public's involvement, the new NEP approach successfully identified the major problems often referred to as "key management issues." Through a consensus basis, the new structure under the twenty-eight NEPs each developed a Comprehensive Conservation and Management Plan (CCMP) and a supporting comprehensive, regional monitoring plan. The monitoring plans enabled the NEPs to determine the success (or weaknesses) of their management actions. State of the Bay Reports communicated the results to managers and the public. Mid-course corrections could then be made and less successful methodologies could be discontinued.

Today, the NEPs are moving aggressively ahead with federal, state, and academic communities to revise and fine-tune their Monitoring Plans and to develop and implement a comprehensive, regional suite of indicators. Utilizing this new strategy, many NEPs have been increasingly successful in preserving and protecting a wide range of coastal waters and wetlands which are now reported on an annual basis and demonstrate the effectiveness of the National Estuary Program.

### **WHAT IS A MARINE PROTECTED AREA? A COMPARISON OF DEFINITIONS AND ANALYSIS OF THEIR POLICY IMPACTS**

*Misty Jo Hamilton, University of Rhode Island*

Marine protected areas (MPAs) have gained increasing attention over the past several years due mostly to increased awareness and use of the marine environment. The need to protect marine areas has become a topic of discussion worldwide, yet there remains a multitude of variations on the definition of an MPA. The use of the term ranges from broad definitions which encompass many values, to the more specific, focused on conservation, law, and/or use values. Although a clear definition of a marine protected area would clarify discussions amongst stakeholders and managers, consensus is not necessary for MPAs to be successful as management tools. The term MPA should be used as an umbrella term that encapsulates the various types of MPAs that might be created; and special care should be taken to set clear and specific goals for each individual MPA.

### **COASTWATCHING BY COMPUTER**

*Pat Harcourt, Waquoit Bay Research Reserve*

Coastal systems form the dynamic interface between land and sea. Because of the number of factors interacting at the coast, conditions are extremely variable. Winds, tides, temperatures, and currents are just a few of the parameters affecting everything from erosion rates to plankton density. Development at the coast and in coastal watersheds brings nutrient loading, shoreline armoring, interruptions to sediment transport, and many other impacts. Monitoring the status of conditions in coastal waters is of great interest to both citizens and managers.

With the development of the internet and improved instrumentation, coastal managers and concerned citizens now have access to specific and detailed information about conditions at many coastal sites. This session will include an introduction to some uses of coastal data for citizens, educators, and managers, a sampling of web sites where coastal data are collected and archived, and instructions for downloading and formatting data for your own use.

### **USING GIS TO MEASURE PERFORMANCE INDICATORS FOR COASTAL HAZARDS IN WISCONSIN**

*David Hart, University of Wisconsin Sea Grant Institute, Alberto Vargas, Wisconsin Coastal Management Program*

Geographic information systems provide a useful tool for measuring the performance of coastal management programs. Over the past nine years, a great deal of effort has been expended to build an

integrated GIS for the Great Lakes coast in Wisconsin. As a result, there is a rich store of local, regional, and state government spatial data that can be utilized to support decision-making about coastal management. This presentation examines the development of coastal performance indicators in Wisconsin and the use of the Great Lakes GIS to assess progress in coastal management related to coastal hazards, including identification of recession rates and counting structures in erosion hazard areas. The presentation will also discuss the impact of public meetings in Bayfield and Ozaukee Counties to present information on the nature and extent of coastal hazards. The authors also discuss a collaborative project between the Wisconsin Coastal Management Program and UW Sea Grant Institute to develop a coastal performance measurement system for Wisconsin within the context of the current NOAA initiative to build a national coastal performance measurement system.

#### **QUONSET-DAVISVILLE, RHODE ISLAND: THE PROCESS WORKS**

*Bernward Hay, Louis Berger Group, Inc., Victor Calabretta, Maguire Group, Inc., Geoff Grout, Rhode Island Economic Development Corporation*

Quonset-Davisville is a former Navy Facility on the western shore of Narragansett Bay, Rhode Island. The Quonset Point Naval Air Station was declared surplus in the 1972 round of Base Closures and the Davisville Construction Battalion Center in the 1992 round. The facilities were taken over by the State of Rhode Island and, while they saw some economic development activity, the achievements did not match the potential afforded by the 3,000 acres of waterfront land, accessed by a 35 ft deep channel and containing an airport with a 3,000 ft runway. In 2001, the Governor of Rhode Island, inspired by a proposal from a private developer to construct a large container port at Quonset, filed an application with the US Army Corps of Engineers to deepen the channel and construct the container port. This action triggered the need for an environmental impact statement. The EIS activities were carried on under the guidance of the Corps for 2 years and included baseline data acquisition of marine habitats, wildlife, sediments and circulation. Equally as important were studies relative to development feasibility and economic justification for the port. In 2003, newly-elected Governor Carcieri embraced a different strategic plan for Quonset-Davisville. He concluded that a large container port was not economically feasible or consistent with the region's quality of life. Instead, he developed a plan for Quonset-Davisville that focuses on a more diverse mix of business uses for the land. The EIS process has continued in support of this new vision.

#### **PANEL: THE ECOLOGY OF GOVERNANCE: INTERGOVERNMENTAL ASPECTS OF ECOSYSTEM MANAGEMENT**

*Timothy Hennessey, University of Rhode Island*

This panel will focus on the intergovernmental requirements of coastal ecosystem management. Mark Imperial from the University of North Carolina at Wilmington will give a paper entitled "Expectations and Reality: Making Watershed Management Work" which examines the challenges of controlling non point source pollution in a watershed context through an analysis of the implementation of the 6217 program. Tim Hennessey from The University of Rhode Island will deliver a paper entitled "The Paradox of Watershed Management" which examines the efforts in the Chesapeake Bay Program to deal with nonpoint source pollution coming from agricultural sources. Lawrence Juda from the University of Rhode Island will give a paper which focuses on "Governance Designs for Large Marine Ecosystems."

#### **A MONITORING PROTOCOL FOR RECREATIONAL NON-CONSUMPTIVE USE OF MARINE PROTECTED AREAS IN THE CHANNEL ISLANDS NATIONAL MARINE SANCTUARY**

*Kristine Lynn Herrington, University of California, Santa Barbara*

The designation of twelve Marine Protected Areas (MPAs) in the Channel Islands National Marine Sanctuary (CINMS) in April 2003 will likely have varying short and long-term economic impacts on the different user groups. Participants at the Channel Islands Socioeconomic Monitoring Workshop hosted by the CINMS and the California Department of Fish and Game in March 2003 recognized the lack of formal studies on the economic impacts of MPAs to recreational non-consumptive users (non-



consumptive diving, kayaking, wildlife viewing, education and research). Demand for non-consumptive recreation inside MPAs may increase due to an actual and/or perceived improvement in ecological conditions such as increase in size, quantity, or diversity of marine life within the MPAs. To aid in long-term socioeconomic monitoring of the MPAs, we developed a monitoring protocol that utilizes the Travel Cost Method to determine the recreational non-consumptive value of the MPAs by the charter industry users. Since the MPAs are located within the Channel Islands National Marine Sanctuary, we designed methodology to specifically differentiate whether or not the recreational non-consumptive value should be attributed to the Sanctuary as a whole or to the establishment of the MPAs. We recommend that this monitoring protocol be used with a comprehensive ecological and socioeconomic monitoring plan to better understand the impacts of the MPAs. Comprehensive monitoring analysis will help assess the effectiveness of MPA management, as well as provide valuable information for related local businesses.

#### **THE GREENWICH BAY SPECIAL AREA MANAGEMENT PLAN: INTEGRATED MANAGEMENT AT THE WATERSHED SCALE**

*Megan Higgins, RI Coastal Resources Management Council, Glenn Ricci, Coastal Services Center*

The Rhode Island Coastal Resources Management Council (CRMC) is coordinating with towns, government agencies, and community organizations to prepare the Greenwich Bay Special Area Management Plan (SAMP). This SAMP poses unique governance challenges in that it focuses on a highly urban coastal area at a watershed scale. The SAMP adapted good governance models to fit the needs of influential stakeholders, local authorities, scientists and the public.

A Citizens Advisory Committee was established to develop the SAMP's vision and goals. The public's perceptions of the planning and participation process, along with their knowledge and skills, were quantitatively measured during the early planning stage. Perceptions were measured to develop a baseline on how the process is being perceived as well as how to adapt the process over the life of the planning process. The goal is to encourage the citizens to establish a watershed coalition that acts as stewards for Greenwich Bay.

The Technical Advisory Committee, consisting of members of government agencies, municipal and county officials, and universities, provided data and expertise within specific areas related to the Greenwich Bay SAMP. They provided science-based policies in order to attain the goals of the SAMP. The Technical Committee has collected data, assessed water quality, identified current activities by various organizations and is currently drafting policies.

#### **SOUTH COAST HABITAT RESTORATION PROJECT**

*Megan Higgins, Janet Freedman, RI Coastal Resources Management Council*

The Rhode Island Coastal Resources Management Council (CRMC) and the US Army Corps of Engineers have been working on the South Coast Habitat Restoration Project to restore fifty-seven acres of essential fish habitat in the coastal lagoons along Rhode Island's south shore. Eelgrass habitat is being buried under a rapidly advancing flood tidal delta in Ninigret and Quonochontaug Ponds. Sand that is diverted into the coastal lagoons is lost from the littoral system. As a result, the sediment starvation to the ocean beaches is amplified. Researchers from the University of Rhode Island and University of New Hampshire have measured the extent of delta accretion, the loss of coastal beach, and have modeled parameters for eelgrass growth to determine the best restoration methods.

This is the largest restoration project in New England. It will improve aquatic habitat of the shoaled-in salt ponds through selective dredging, planting of eelgrass, and establishing sedimentation basins to prevent future shoaling and subsequent loss of restored and existing eelgrass beds. CRMC, the nonfederal sponsor of the project, is responsible for the long-term maintenance/clean out of the sedimentation basin and post-monitoring of the project area.

#### **MEASURING THE EFFECTIVENESS OF PUBLIC PARTICIPATORY PROCESS TRAINING**

*Lynne Hinkey, Ginger Hinchcliff, NOAA Coastal Services Center*

The NOAA Coastal Services Center has been delivering training on Public Issues and Conflict Management since September 2000. More than 700 coastal resource managers have participated in thirty workshops across the country. The workshop design included an outcome-based evaluation plan to determine the effectiveness of this training in improving the ability of coastal resource management professionals to address public issues in a participatory manner.

Survey instruments were used to gather information on the participants' learning, the application of the information, skills, tools to participatory processes, and the impact of this on their ability to use collaborative problem-solving processes to address public issues. Data on participants' knowledge, skills, and abilities were gathered prior to the workshop, immediately upon completion of the training, after approximately one year, and two years after completing the training to evaluate learning retention, application, and impact. This allowed us to draw conclusions about the effectiveness of this training program on participants' ability to resolve issues in a collaborative, public participatory process.

We will discuss the process used for designing the workshop and the evaluation plan. We will also present results showing the learning, application, and impacts of this training on participants' job performance and effectiveness over time.

#### **WATER MASS AGES OF RHODE ISLAND COASTAL WATERS ESTIMATED USING 223Ra AND 224Ra AS TRACERS**

*Andrea Hougham, S. Bradley Moran, Roger P Kelly, URI Graduate School of Oceanography*

The naturally-occurring radium isotopes 223Ra ( $t_{1/2}=11.1$  days) and 224Ra ( $t_{1/2}=3.6$  days) are useful tracers of coastal water age due to their known sources and sinks. Surface and pore water samples were collected quarterly in five southern Rhode Island lagoons (Winnapaug, Quonochontaug, Ninigret, Green Hill, and Pt. Judith/Potter Ponds) from January 2002 through July 2003, and surface water samples were collected monthly in Narragansett Bay from October 2001 through January 2004. Measured 223Ra and 224Ra activities were combined with a simple box model to provide estimates of water mass age ranging from 1-20 days for the southern Rhode Island lagoons and Narragansett Bay. These results are within a factor of two previously reported values for these coastal ponds and Narragansett Bay.

#### **MANAGING PUBLIC BEACH ACCESS: AN ANALYSIS OF BEACH USERS IN WRIGHTSVILLE BEACH, NORTH CAROLINA**

*Mark T. Imperial, Chris Dumas, University of North Carolina at Wilmington*

Local officials in countless barrier beach communities confront a wide range of management challenges associated with providing services and public access facilities that serve seasonal populations and large numbers of daily visitors that utilize public beaches. Wrightsville Beach, North Carolina exemplifies many of these management challenges. Its location and proximity to Interstate 40 make it one of the most heavily used beaches in Southeastern North Carolina. Its numerous public access points, public parking lots, lifeguards, restroom, and other amenities also make it a popular destination for beachgoers. The year round population of approximately 2,600 can swell to well over 10,000 with peak day population estimates of up to 35,000. Thus, local officials are faced with the challenge of providing and funding a variety of services to service this population.

This paper examines these management challenges using data from a survey of beach goers in Wrightsville Beach, North Carolina. The research design utilized a random sampling design to survey the population of beachgoers, along the town's four miles of beach, during a typical weekday and weekend day in the summer of 2003. Beachgoers were asked a series of questions designed to analyze travel and spending behavior, perceptions of town services, willingness to pay, and contingent behavior. This paper describes the results of the survey and the implications for local officials. The paper then explores the management implications for local officials in similar barrier beach communities.

#### **UTILIZING FOCUS GROUPS TO DETERMINE COASTAL COMMUNITY BEACH ACCESS NEEDS IN SOUTHEASTERN NORTH CAROLINA**

*Carla E. Isom, James Herstine, Jeffery Hill, Robert Buerger, University of North Carolina at Wilmington,*

Recent severe storm cycles and chronic beach erosion that threaten beach communities have initiated increasing interest in oceanfront beach nourishment efforts. Since federal funding plays a considerable role in supporting beach nourishment projects, one of the requirements for approval of federal shore protection projects is the provision of adequate public access. Many coastal communities are dependent upon the nourishment of local beaches in providing both direct and indirect economic benefits.

In order to determine governmental and public perceptions concerning the adequacy of public access to select beaches in North Carolina, researchers at the University of North Carolina at Wilmington undertook an Army Corps of Engineers funded analysis of 67 miles of oceanfront beaches in the southeastern section of the state from summer 2003 through spring 2004. The project consists of five distinct, but interrelated phases 1) field surveys, 2) aerial photography, 3) a telephone survey, 4) a survey of secondary sources, and, 5) focus groups. This presentation concentrates on phase five: focus groups.

Focus groups will be conducted during January and February of 2004. They will concentrate on forecasting beach usage, trends, and expectations for the respective beach communities. The focus groups will include municipal officials, business leaders, community representatives and citizens of the communities. A total of ten focus groups will be convened in eleven municipalities along the southeastern North Carolina coast. Since the data collection period is scheduled for early 2004, preliminary data analysis is not yet available. Data analysis will be concluded at the end March 2004.

### **COASTAL STORMS INITIATIVE: RISK AND VULNERABILITY ASSESSMENT TOOL**

*Russell W. Jackson, NOAA Coastal Services Center*

The Coastal Storms Initiative (CSI) is a nationwide effort led by the National Oceanic and Atmospheric Administration (NOAA) to lessen impacts to coastal communities from storms. As part of the CSI, the NOAA Coastal Services Center developed a tool for conducting risk and vulnerability assessments. The Risk and Vulnerability Assessment Tool (RVAT), one of nine CSI projects piloted in the St. Johns River Watershed in Florida, involved the development of an on-line spatial analysis tool for conducting these assessments in Brevard and Volusia Counties. Communities need to be able to identify their risks and vulnerabilities to coastal storms to create effective hazard mitigation strategies and reduce storm impacts.

RVAT is an extension of the methodology contained in the Community Vulnerability Assessment Tool, <<http://www.csc.noaa.gov/products/nchaz/startup.htm>>, which involves the examination of physical, social, economic, and environmental vulnerability at the community level to enhance objectivity in developing proactive hazard mitigation, emergency response, and disaster recovery strategies. By engaging community officials in the development of RVAT, NOAA is striving to ensure that communities are equipped with the right information in the right format to prepare for coastal storms. To help accomplish this goal, RVAT is accessible on the Internet and affords spatial analysis functionality without requiring users to have geographic information system software. Enhanced access to risk and vulnerability assessment data enables an informed citizenry to work with local officials to make improved decisions related to coastal storms. RVAT can be accessed at: <http://www.csc.noaa.gov/rvat/>.

### **THE PERCEPTION OF A BEACH IN A MODERN TOURIST: IS THE SANDY BEACH A PLACE OF CONFLICT BETWEEN TOURISM AND BIODIVERSITY?**

*Marcin Filip Jedrzejczak, Institute of Oceanology PAS*

Since the 1950s, as people were gaining access to more free time, coastal areas have become increasingly desirable as holiday destinations. Beach tourism has grown at an enormous rate and is becoming a mass phenomenon. Next to their ecological importance as bio-filters, sandy beaches in Europe tend to be of great economic value through tourism. Modern tourists are largely peaceful, but tourism itself creates much damage to the environment. A current and common effect of tourist influence on European seas is the diffusion of plastic debris on the coasts, either abandoned by beach users or deposited by the sea during storms.

There are some four to eight million tourists resting each year on Polish beaches. What is the purpose of their visit? What things do they most dislike there? What is their perfect coastal landscape of the sea? What is their image of the beach life? Questionnaire surveys, carried out during summer 2003, aimed

at ascertaining what public opinion was/is regarding beach perception, were useful to answer the questions. At each site, people filled out the questionnaires asking their opinion of the beach, scenery, animals and aesthetics.

In the modern, democratic society, the public, stakeholders, not the experts are having the final word. It creates, however, problems with public opinion: there is seldom direct experience, and there is not common perception of the values. Do we value in a similar way? For many, the plastic net cover on a cliff and the coastal motorway is more attractive than an underdeveloped shore.

#### **MEASURING ECONOMIC INCENTIVES FOR USING NONTOXIC ANTIFOULING STRATEGIES**

*Leigh Taylor Johnson, University of California Sea Grant, Richard Carson, University of California, San Diego, Maria Damon, University of California, San Diego, Jamie Anne Miller, University of California Sea Grant*

Dissolved copper in Southern California boat basins may reach 29.0µg/l. When dissolved copper exceeds state and federal standards of 3.1µg/l, it is toxic to mussels, oysters, sea urchins and crustaceans. Much of this copper comes from antifouling paints. TMDL programs by California Regional Water Quality Control Boards are addressing this problem. Nontoxic antifouling strategies offer a new paradigm to control fouling growth and reduce copper pollution. Nontoxic boat bottom coatings require frequent cleaning of fouling growth and old copper paint must be removed before they are applied. In 2002 the University of California Sea Grant Extension Program and the University of California, San Diego Department of Economics studied incentives for boat owners in San Diego Bay to switch to nontoxic alternatives to antifouling paints. Boat owners and repair, maintenance, and coating companies were surveyed. Boaters would pay \$700 to wait a year to paint their boat and \$500 more for a nontoxic coating, instead of copper-based paint. The top three factors cited by boaters in deciding whether to switch to nontoxic coatings were: greater longevity, a legal requirement, and a cleaner bay. Phasing out copper-based bottom paints in San Diego Bay would cost \$twenty million over seven years, but only \$one million over fifteen years. The longer period would allow boats to be converted when they were ready to be stripped. Announcing a future ban on copper-based paints would raise the value of boats with nontoxic bottom coatings. Their longevity could make up for conversion and maintenance costs.

#### **THE CAPE WIND PROPOSAL: CHALLENGES AND OPPORTUNITIES IN OCEAN GOVERNANCE**

*David Joyce, University of Miami*

The first offshore wind farm planned for the coastal waters of the United States is currently under review by the Army Corps of Engineers. Although offshore wind energy is emerging as a successful “green” energy source in parts of Europe, its application in the United States is just beginning. As proposed, the Cape Wind project would be the largest offshore wind development in the world and would be located in Nantucket Sound, a marine environment that engenders strong opinions from myriad stakeholder groups. No federal statutory program designed to regulate offshore wind farms exists, thus giving rise to novel debates of energy policy and ocean governance. The lack of specific legal guidelines by which to analyze the proposal has resulted in an unprecedented review process. This paper considers three primary issues resulting from the Cape Wind proposal and their potential impacts on domestic ocean governance. First, I examine the existing legal structure and its inability to apply to offshore wind farm development. Second, the complex web of federal, state, and local agencies involved in the permitting process suggests a need for a streamlined approach to reaching offshore ocean policy decisions. Third, through consideration of each major stakeholder, I demonstrate how the Cape Wind project exemplifies the vast cultural, social, political, and economic factors associated with ocean development. Regardless of whether the specific Cape Wind project is approved, the management issues raised through this proposal reflect the need for successful ocean governance.

#### **COASTAL HABITAT RESTORATION IN THE GULF OF MAINE**

*Jon Kachmar, Maine Coastal Program*

A partnership between the Gulf of Maine Council on the Marine Environment and NOAA’s National Marine Fisheries Service is currently completing a three-year partnership for restoring coastal

habitat in the Gulf of Maine. To date, this partnership has funded twenty-two restoration projects in Massachusetts, New Hampshire, Maine and Nova Scotia, with another grant award expected in April 2004. The types of projects funded include pre and post restoration monitoring; removal of tidal restrictions to salt marshes; and dam removal, modification or fish passage.

The partnership has completed a Gulf of Maine Regional Habitat Restoration Strategy that identifies critical habitat on a regional scale in the Gulf, including riverine; intertidal; subtidal; and beaches, dunes, islands and ledges above high water. The strategy considers the need to restore habitat based on the migratory fish, birds, and mammals that utilize the Gulf of Maine during some portion of their lifecycle. The Gulf is critically important to the health of several species. For example, most of the global population of semipalmated sandpipers, roughly one million birds, migrates through the upper Bay of Fundy to feed on the mudflats in New Brunswick and Nova Scotia.

The intended purpose of presenting at The Coastal Society conference this May is to introduce coastal resources managers to the restoration that is occurring in the Gulf of Maine via a PowerPoint presentation that includes why restoration was undertaken, what methods of restoration were utilized, and how it fits into regional restoration efforts in the Gulf.

#### **COASTAL MARINE DEVELOPMENT AND POLICY: AN ECOSYSTEM BASED APPROACH TO COASTAL MANAGEMENT AND EDUCATION**

*Ilene M Kaplan, Union College and WHOI, Barbara C. Boyer, Union College and MBL*

Ecosystem-based management can effectively increase our understanding of diverse but related marine systems and the regulations that need to balance both use and protection of coastal environments. This approach takes into account the different components of the coastal environment and is interdisciplinary, including biological, social, physical and technological elements and the interrelationships that emerge. Improved educational programs that incorporate and integrate ecosystem-based assessments of the coastal environment should improve public understanding and result in increased compliance to coastal zone policy. Interdisciplinary and ecosystem oriented educational projects are presented using examples from coastal communities in Bermuda, Newfoundland and New England. The educational projects that are discussed were initiated as part of the Marine Studies Term Abroad, Union College, Schenectady, New York.

#### **EVALUATING MANAGEMENT EFFECTIVENESS: NOAA'S NATIONAL CORAL REEF ECOSYSTEM MONITORING PROGRAM**

*Ruth Kelty, NOAA Centers for Coastal Ocean Science*

Coral reefs ecosystems are under threat from multiple stresses that are overwhelming their natural resilience - 27% of the world's coral reefs have been effectively lost due to human activities and climate impacts; an additional 32% are seriously threatened (Wilkinson 2000). In response, Congress appropriated \$71M between FY2001 and 2003 to support mapping, monitoring, restoration, research, management, and education for coral reef conservation. Responsible policymakers need to take an unbiased look at what we've achieved in return for this investment in coral reef ecosystems. Has our money been well spent? Has it been spent on the right things? Is there something more we should be doing? NOAA's National Coral Reef Ecosystem Monitoring Program (Monitoring Program) is a tool for evaluating coral reef ecosystem management efforts and identifying the changing needs of coral reef ecosystems and their users. The goal of the Monitoring Program is to build a scientific basis, create state and territory capacity to monitor the status and trends in the condition and function of U.S. coral reef ecosystems, and to use the state of the reef to evaluate the effectiveness of management. The Monitoring Program cumulates in the production of biennial State of the Reefs reports. In this presentation, I articulate the Monitoring Program goals and objectives, identify questions central to evaluating the state of coral reef ecosystems, and define critical program functions and corresponding performance criteria and measures. Applied examples for biological and socioeconomic monitoring are offered.

## **SCIENCE-BASED GUIDELINES FOR RESIDENTIAL DOCK AND PIER MANAGEMENT: A SYNTHESIS OF ENVIRONMENTAL AND AESTHETIC IMPACTS**

*Ruth Kelty, NOAA Centers for Coastal Ocean Science, Steve Bliven, Bliven & Sternack*

To comprehensively manage docks, coastal managers must have both the latest science to support their decisions, and the laws and policies in place to implement new management techniques. While docks have the potential to interfere with navigation and public access, and impact natural resources and coastal aesthetics, their direct, cumulative, and secondary impacts are not well documented. NOAA's National Centers for Coastal Ocean Science hosted a workshop to synthesize the latest scientific data and management tools relating to the siting and construction of small docks and piers. Scientists and managers representing the Southeast, Mid-Atlantic, Northeast, Great Lakes, and Pacific discussed what is known (and not known) about how docks and associated boating activities individually and collectively impact vegetation, sediments, sedimentation, contamination, navigation, public trust rights, and aesthetics/quality of life. This talk presents the results of that workshop and 1) reviews the state of existing knowledge, 2) identifies gaps in our understanding and offers recommendations to fill them, and 3) presents recommendations to guide the development or revision of State dock and pier permitting processes. Biophysical and socioeconomic data are presented.

Workshop proceedings and a searchable database of scientific information are available at <http://coastalscience.noaa.gov/publications/notables.html#d>. Also see *Management and Construction Tools to Minimize Impacts of Residential Docks and Piers* (A. Castellan) and *Visual Impact Assessment of Docks and Piers – Theory and Practice* (S. Bliven).

## **AN EVALUATION OF MARINE PROTECTED AREA DESIGNATION PROCESSES IN THE UNITED STATES: UNDERSTANDING THE ROLE OF STAKEHOLDER INVOLVEMENT**

*Brie Kessler, PSGS/ NOAA Coastal Services Center*

This project critically evaluated how to engage stakeholders constructively in marine protected area (MPA) designation processes. Currently there is not widespread agreement on how to design an MPA planning process that engages stakeholders in meaningful and equitable dialogue and decision-making. Although each MPA process is tailored to local issues, stakeholders, and environmental conditions, a review of stakeholder participation in past processes may begin to map out an overall framework for involvement. This project looked at five MPA designation processes, documented how stakeholder participation was incorporated into each process, and analyzed each process for the presence or absence of the guidelines suggested in the literature for effective stakeholder participation. For each criterion that was present within a process, a score was assigned (low, medium, or high) and a descriptive entry of supporting evidence for why it was coded as such was created. These case studies have demonstrated that establishing true participation, as it is defined, is a lot more difficult in practice than theoretical conceptions assume. Unlike a recipe, where specific ingredients lead to a specific result, different processes may contain many of the same process elements but lead to a variety of outcomes depending on how various contextual and capacity-based factors influenced the process. Consequently, a definitive recipe for designing and conducting an effective stakeholder participation process may be elusive. Overall, the results of this project are intended to provide insight into how to engage stakeholders constructively in MPA processes in both theoretical and practical terms.

## **THE USE OF GRASS SHRIMP, PALAEMONETES SPECIES, AS A SENTINEL OF ANTHROPOGENIC IMPACTS ON COASTAL SYSTEMS**

*Peter B. Key, National Ocean Service, Edward F. Wirth, National Ocean Service*

Coastal systems in the U.S. are ecologically important aquatic environments. These ecosystems, which include estuaries, coastal wetlands, coral reefs, and mangrove forests, provide spawning grounds, nurseries, shelter and food for many species. Coastal areas also serve as sinks for pollutants transported via point and non-point source runoff and atmospheric deposition. Management of pollutant risks to predict ecological effects involves attempts to determine whether coastal areas are threatened or damaged from elevated concentrations of anthropogenic chemicals. Traditionally, this has focused on simple

measurements of chemical concentrations without considering the ecology of the components of the coastal system or the interactions between the system and the compounds of interest. Work is now becoming focused on ecologically relevant measures of loss and depletion. Grass shrimp, a common inhabitant of East and Gulf Coast estuaries, have been proposed as one of these measures. Grass shrimp have been used as a model organism in ecological monitoring studies, in situ and laboratory toxicity tests, and development of biomarkers of exposure. Given the amount of data available for grass shrimp, this species has the potential to serve as an important indicator for sub-organismal to community level effects. This poster will briefly review the role of grass shrimp in scientific studies related to human impact on coastal systems. More importantly, it will show the need to integrate these quantitative tests so that environmental managers can use this crustacean as a model species to make informed decisions of coastal system assessment.

#### **ECONOMIC AND DEMOGRAPHIC DIMENSIONS OF COASTAL ZONE LAND USE CHANGES**

*Judith Tegger KILDOW, Cal State Univ. at Monterey Bay, Charles S. Colgan, Univ of Southern Maine*

The coastal landscape is in transition. America's traditional shoreside industries of ship building and fishing are in decline; cottage industries and quiet seaside cabins are being replaced by a booming tourist industry, replete with hotels, restaurants, strip malls and trophy homes. As pavement replaces soils, and runoff, formerly absorbed into the land, flows to the sea as toxic soup, beach closings frustrate the growing number of tourists wanting to enjoy a sunny day at the shore. What is driving these changes? How can we manage them?

These land use changes in the coastal zone are driven by important demographic and economic changes. This presentation examines changes in the thirty coastal and Great Lakes states from 1990-2000 in three regions: the near shore, the coastal zone (as defined for the CZMA) and coastal watersheds. Population and housing changes are examined in light of Census data and employment and output changes in each region are analyzed using new data derived from employment and gross state product data. Both total change and change associated with ocean-related economic activity are examined and differing patterns of demographic and economic change in coastal states are identified. This analysis will show differing patterns of population and economic growth in the coastal zone with significant implications for land use patterns. The presentation will also present how improved economic information can assist understanding of land use changes and their relationship to coastal resources.

#### **MICROBIAL SOURCE TRACKING: DIFFERENTIAL COLIPHAGE REPLICATION LEADS TO BIASED RESULTS IN ENRICHMENT STUDIES.**

*Marek Kirs, University of Rhode Island, David C Smith, University of Rhode Island*

Although it is well documented that microbial contamination of coastal waters poses a significant risk to human health through recreational exposure and consumption of shellfish, the source of the contamination plays a dominant role in dictating the level of actual risk. The ratio of four subgroups of F-specific RNA coliphages in the family Leviviridae has been used to distinguish human from non-human sources of contamination. Due to low concentrations of these phages in water samples, enrichments are employed for their detection. A critical assumption of this method is that the in situ ratio of the subgroups is maintained during the enrichment. To test this, triplicate enrichment experiments were conducted using equal titres of all four coliphage subgroups and *E. coli* FAMP as the host. At the end of the 24-hour enrichment, subgroup I (MS2) had highest titres while subgroup II (GA) had the lowest titres (ANOVA, Bonferroni adjustment,  $P < 0.05$ ). To address the reasons for these differences, one-step burst size experiments were conducted. Assuming 100% infection efficiency (1:10 phage host ratio), there were significant differences ( $P < 0.05$ ) in burst sizes between and within the groups. Burst sizes for representative coliphages from subgroups I, II, III and IV averaged 507 (MS2), 75 (GA) 233, (Q-β) and 181 (F1) respectively. This differential in replication results in biasing enrichment experiments towards subgroups associated with animal waste. Due to significant differences in replication characteristics, the enrichment technique cannot be recommended for F-specific RNA coliphage assay for microbial source tracking.

**ASSESSMENT OF INLET HAZARD AREAS OF ENVIRONMENTAL CONCERN USING RECTIFIED AERIAL PHOTOGRAPHY FOR IMPROVED MANAGEMENT OF COASTAL DEVELOPMENT IN NORTH CAROLINA**

*Julia M Knisel, NC Division of Coastal Management, Stephen B. Benton, NC Division of Coastal Management, Margery F. Overton, NC State University*

North Carolina passed the Coastal Area Management Act in 1974 and then developed regulations in 1978 to limit development in coastal environments. Inlet Hazard Areas of Environmental Concern (IHAEC) were defined as natural-hazard areas that are vulnerable to erosion, flooding and other adverse effects of sand, wind, and water because of their proximity to dynamic ocean inlets. The open ocean shoreline of North Carolina maintains twenty-one inlets. Shorelines adjacent to inlets are affected by changes in sediment distribution and inlet morphology. An inlet migration study was conducted in 1978 to facilitate the delineation of IHAEC. More than twenty years have passed and development and transportation infrastructure are at risk in North Carolina. Coastal managers require a new assessment of inlet and adjacent shoreline changes to revise IHAEC, develop more effective regulations, and inform the public of risks. Historical changes in shoreline position can be determined from aerial photography. Photos of Hatteras Inlet between 1940 and 1998 were selected with an interval of approximately ten years. Photogrammetric software, Erdas IMAGINE 8.5 with OrthoBASE Pro, was used to remove scale variation, tilt, and radial lens distortion from scanned images. A high water line, which indicates the landward extent of the last high tide, was digitized from each set of rectified images using ArcView 3.2 to monitor historical shoreline changes. Shorelines were analyzed to assess the nature of Hatteras Inlet and delineate a new IHAEC. This study provided the framework for the update of the remaining IHAEC in North Carolina.

**IMPORTANCE OF TERRESTRIAL LEAVES TRANSPORTED FROM UPSTREAM FOREST ON COASTAL MACROINVERTEBRATES AS A FOOD RESOURCE.**

*Kaori Kochi, The University of Tokyo, Seiji Yanai, Hokkaido Institute of Technology*

Many rivers in East Asia were disrupted recently by artificial dams for the purpose of erosion control and/ or irrigation. Thus, the input pattern of organic materials, such as leaves and branches that transport from upstream forests to the coast was changed, or the amount of leaves was reduced. Little information is still available on utilization of forest-origin organic matter by seawater inhabiting species in coastal areas, except mangrove forest.

Our purpose in this study was first to clarify the tree leaf utilization by the coastal macroinvertebrate species (e.g. amphipod) with a leaf decomposition experiment. The second purpose was to estimate the growth rate of the macroinvertebrate with a feeding experiment. We used deciduous tree leaves from a forest bed and riverbed for the decomposition experiment and compared the decomposition rate with seaweed. Decomposition rate was fastest in kelp (*Laminaria religiosa* Miyabe) among the items, following oak (*Quercus mongolica* var. *grosseserrata*) dead leaves from a riverbed, and slowest in oak dead leaves from a forest bed that does not experience water conditioning. The feeding experiment used seawater shrimp (*Anisogammarus pugettensis*), which grew fastest when oak leaves and seaweed were supplied together. By the experiment, the leaf availability was enhanced through river water conditioning was indicated. Importance of input of tree leaves in addition to seaweed for the shrimp growth was also shown. The terrestrial leaves would eventually affect fish production that feed these macroinvertebrates.

**LINKING ECOLOGY AND CULTURE THROUGH A COASTAL LANDSCAPE**

*Laura Kracker, Carol Preston, NOAA National Ocean Service - CCEHBR*

The coastal landscape in and around Cape Romain National Wildlife Refuge in South Carolina has deep meaning for the communities that are connected to it through subsistence, commercial and recreational activities. This paper defines the interaction between the ecology of the place and the socio-economic and cultural use of its resources. Historically, this coastal landscape has provided a means by which basketmaking, fishing and shrimping have thrived. We discuss the changing nature of cultural, ecological, and economic relationships in this region as coastal development progresses. Through discussions with stakeholders, we identified elements that make this landscape a significant place with



strong emotional, socioeconomic, historic, and cultural connections. A conceptual model was developed that identifies external drivers and stressors, as well as the cultural and economic realities of the region. We apply landscape ecology concepts to one component of that model to describe the relationship between the health of natural resources (sweetgrass) and a traditional activity (basketmaking by Gullah families). The decline of native-growing sweetgrass in the path of urbanization and beach front development illustrates the changing relationships among raw materials, Gullah artisans, and tourist markets that are important to the survival of a traditional way of life. We define these interactions and impacts in the context of traditional coastal communities in order to consider both cultural and ecological aspects of coastal stewardship.

#### **STEWARDSHIP OF LONG ISLAND SOUND'S ECOLOGICAL AND RECREATIONAL RESOURCES**

*Robin Kriesberg, Save the Sound, Inc., Thomas A. Halavik, US Fish and Wildlife Service*

An initiative is underway to identify, protect and enhance special places throughout Long Island Sound. Under the leadership of Save the Sound, the Regional Plan Association, and Audubon New York, the goals of this effort are to:

- Identify special places with significant biological, scientific or recreational value throughout LIS
- Develop a strategy to protect and enhance those special places

An inventory of two resource types, recreation/open space and ecological/scientific, was conducted. Maps were produced based on a set of criteria for data and consultation with local experts. These results, displayed using Geographic Information System (GIS), will be presented to the public for input and used to help prioritize future work.

Data layers were combined to identify the most significant sites. Additional criteria for underwater resources are being developed, although work is not as far along in this area.

A series of public meetings is scheduled for late 2004. They will present the assessment results and options for improved coordination of stewardship around the Sound. In addition to identifying omissions or data gaps, the public will be asked to consider the following three approaches:

- Use data collected by the resource assessments to target existing initiatives
- Establish a formal network of sites within a Stewardship System
- Create a new program based on a legislative action by Congress

#### **ECOLOGICAL EVALUATION OF NEAR-SHORE SPOTS AS KEY TO LEGALIZE MARINE PROTECTED AREAS AT THE COASTLINE OF AKLAN, PHILIPPINES**

*Kai Jens Kuhlmann, German Development Service (DED)*

In the eleven coastal Municipalities of the Province of Aklan, Philippines, near-shore spots to be legally established as marine protected areas (MPA s) have been assessed by manta tow and transect dives in 2003. The assessment highlighted approaches to local stakeholders dealing with the socio-ecological conflict of scarce food, degrading coastal environment and incessantly growing population in rural coastal areas.

Surface composition, hard coral coverage and standing fish biomass were quantified at each spot to derive a ranking based on ecological conditions. Municipal ordinances involving specifically outlined management plans were drafted and discussed with local government units, municipal fisheries councils and local NGO s during a province-wide planning workshop. At five spots, flat sand bottom but no corals reefs dominated, while at four spots fringing and patch reefs resulted in fair conditions with coral rocks and dead standing corals remarkably overgrown by algae. Two areas resulted in good and very good conditions with potential hard coral cover of massive and table-like growing forms.

Municipal ordinances and MPA management plans, jointly drawn by involved stakeholders, contain artificial reef construction inside selected MPA s, locally suitable livelihood alternatives, and CRM-related curricula for Aklan schools. These endeavors shall serve as a basis to raise law enforcement, environmental awareness, and income generating support.

**AN EXAMINATION OF CHILDREN'S ENVIRONMENTAL ATTITUDES AS A FUNCTION OF PARTICIPATION IN ENVIRONMENTAL EDUCATION PROGRAMS**

*Marnie Laing, University of Rhode Island*

The goal of this study is to evaluate the role of environmental education in enhancing environmental knowledge, awareness, and responsibility. This paper examines an environmental education program for primary school children in the Cayman Islands. As a means of assessing the effects of environmental education, children in a test group (those who participated in an educational program) and a control group (those who did not participate) were requested to evaluate statements concerning environmental knowledge and potential human impacts on resources. The evaluation questions were posed both before and after the test group participated in the program. The program focuses primarily on exploration of environments such as mangrove systems around the islands. The participants were also asked to express their beliefs and feelings about nature by commenting on photographs of landscapes. This research contributes to a better understanding of how environmental education programs positively impact children's attitudes, beliefs, and values concerning nature. Sharing the information from this research with the community of Grand Cayman may assist with the creation of interactive educational programs for children, enhancing knowledge of the ecology of the island. Environmental education programs and experiences in nature may help to improve a child's knowledge of the environment and develop children's action skills. This can have a significant effect on the future of a nation's natural resources.

**NORTHEAST OCEAN COMMISSIONS REGIONAL BREAKOUT SESSION**

*Virginia Lee, URI Coastal Resources Center, Gib Chase, U.S. Fish & Wildlife Service*

Group discussion will focus on the need for integrated and ecosystem-based ocean planning and management, a primary recommendation of the U.S. Commission on Ocean Policy and the Pew Oceans Commission. Discussion will also address the establishment of a regional ocean ecosystem council for comprehensive and coordinated approach and new governance of our Northeast region, as recommended by the two commissions. The topics of importance would be a shared vision, coalition building, unified management plan, and shared management objectives to protect shared resources. Examples of regional initiatives will be presented and follow-up discussion will be facilitated.

**SPATIAL MODELING TO DETERMINE OPTIMAL FRESHWATER INFLOWS INTO ESTUARINE HABITATS IN THE ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE**

*Jesse M. Lewis, Florida Marine Research Institute, Mike A. Shirley, Florida Department of Env. Protection, George E. Henderson, Florida Marine Research Institute, Patrick O'Donnell, Florida DEP, Stanley D. Locker, USF College of Marine Science, Peter Rubec, Florida Marine Research Institute*

Rookery Bay National Estuarine Research Reserve (RBNERR), located just south of Naples, Florida, has experienced large fluctuations of freshwater inflow, which has had a significant impact on fish and invertebrate species within the estuary. Historically, Rookery Bay had freshwater inflows of 2,500 cubic feet per second per month (cfs/month), but during the early 1990s, the inflows regularly exceeded 10,000 cfs/month. Maintaining salinity levels is crucial to conserving and protecting estuarine habitats of Rookery Bay. The Florida Department of Environmental Protection, the Florida Fish and Wildlife Conservation Commission, and the University of South Florida collaborated to determine optimal freshwater inflow from the upstream weir, a dam-like structure that regulates freshwater entering the estuary. Habitat suitability modeling (HSM), using Geographic Information Systems (GIS), was applied to predict seasonal spatial distributions and relative abundance of estuarine species by life stage across Rookery Bay. Physical parameters, such as salinity, dissolved oxygen, bottom type, temperature, and depth were mapped across the estuary. These physical parameters are the habitat layers associated with the model; the habitat affinities for key species are derived from previous HSM work conducted in Charlotte Harbor (nearby estuary). The results from HSM models measure changes in suitability under different flow scenarios. This study will provide water managers of the South Florida Water Management District further

information (based on changes in suitability) that could contribute to better regulation of water quantities through the weir.

#### **A COMPARISON OF WATER QUALITY EFFECTS OF MONTHLY AND ANNUAL BASED POINT SOURCE LOAD REDUCTIONS**

*Lewis C Linker, USEPA/CBPO, Ping Wang, UMCES / CBPO*

Chesapeake Bay physical and biological processes can be viewed as integrating variations of nutrient load magnitude over time. The integration of loads over time ameliorates intra-annual load fluctuations, responding to overall loads on an annual scale, while showing little response to monthly variations within an annual load. This may be due in part from water residence times of more than several months until a given parcel of water is discharged at the mouth of the Chesapeake, or the time that a given nutrient load influences water quality, including thorough recycling of nutrients from the sediments, estimated to be on the order of several years or less. Model scenario findings of insignificant differences between constant monthly and variable monthly point source loads are consistent with the estimates and observations of the literature. Based on the various lines of evidence, and at the scales applied to examine Chesapeake water quality criteria, annually based point source nutrient reductions are sufficient to protect Chesapeake Bay water quality.

#### **CUBAN EXPERIENCE FOR ICZM: IN SEARCH OF THE BEST MECHANISMS FOR THE COORDINATION & DECISION MAKING PROCESSES IN COASTAL ZONE MANAGEMENT IN CUBA**

*Anyeli De la Caridad Lopez Garcia, Directorate of Environment, Minister of*

Effective integrated coastal zone management requires that it be addressed both from the activities within the coastal zone itself and from outside the coastal zone. It is important to consider that the impacts of the activities do not “respect” political or physical boundaries. The identification of a sound and applicable local and regional mechanism for the ICZM in Cuba has been one of the main goals of the National Group for Coastal Zone Management. The group, created in January 2001, is coordinated by the Ministry of Science, Technology and Environment. It is integrated by national agencies and bodies, research institutes and project managers, and others related to the use and exploitation of the coastal zone. Through a very intense and participative process, the group has identified and assessed several mechanisms capable of giving appropriate responses to the challenges of ICZM. The National, Provincial and Municipal Councils of Hydrographic Basins are some of the best organized mechanisms. This paper shows a resume of the structure, functions, and objectives of some of these mechanisms.

#### **SPECIAL THEME SESSION: THE STATE OF SOCIAL SCIENCE AND MARINE PROTECTED AREAS**

*Sarah Lyons, National MPA Center Science Institute, Patrick Christie, UW School of Marine Affairs, Ana Spalding, National MPA Center Science Institute*

The human dimension plays a large role in the effectiveness of coral reef marine protected areas (MPAs). However, the social sciences are often overlooked in the planning, management and evaluation of these MPAs. There is a need for understanding the social, cultural, and economic contexts in which policy maker's conservation decisions will be applied. This session will focus on the current state of social science research as it relates to MPAs. Three presentations will address this topic from various perspectives. Patrick Christie, University of Washington, School of Marine Affairs, will present *Toward developing a complete understanding: A social science research agenda for marine protected area*, a paper recently published in *Fisheries*. Ana Spalding University of Miami, RSMAS/ National MPA Center Science Institute will present an analysis of the gaps and information needs identified to date in the MPA Center's regional social science workshop series. Sarah Lyons, National MPA Center Science Institute, will discuss current issues and efforts relating to the development of national and regional social science research capacities. The presentations will be followed by a facilitated, interactive discussion with the audience members about building the national capacity in respect to integrating social science research into the planning, management and evaluation of MPAs.

## **RECIPROCAL RELATIONSHIPS OF STATE AND LOCAL AGENCIES IN IMPLEMENTATION OF PUBLIC SHORELINE ACCESS: A CASE STUDY OF FOUR SOUTHEASTERN STATES**

*William R. Mangun, East Carolina University, Amy F Blizzard, East Carolina University*

The Coastal Zone Management Act emphasizes the need for states to provide public access to coastal areas for recreational, historical, aesthetic, ecological, and cultural values. Each state was to pass laws to protect public beach access. A National Oceanic and Atmospheric Administration (1999) report indicates that coastal states provide varied levels of support for meeting public access goals, ranging from low to high. Beyond this report, little or no comparative analysis of the effectiveness of state shoreline access programs exists. No research has been published, as well, on the relationships between state agencies and local governments in the implementation of shoreline access programs. The purpose of this study is to address the political, economic, and administrative dimensions involved in the provision of public shoreline access programs in four southeastern states: North Carolina, South Carolina, Georgia, and Florida. The intent of this research is to demonstrate that evaluation of public shoreline access programs must extend beyond the scope of federal-state relationships to the use of quantifiable measures within the context of state-local relationships to fully understand the nature of public shoreline access programs and to effectively examine their success or failure.

The link between state and local agencies provides a framework for political action largely unexplored in policy studies. Intergovernmental policy implementation is an interdependent process involving complex relationships among state and local legislatures and administrations. Successful beach access determinants include state-local political dynamics, extent of financial and technical support, legal interpretations, and local enforcement of regulations.

## **COASTAL LAND USE IN INDIA: A DISCUSSION**

*Sambandam Manickam, APSA College*

Coastal land in India has been utilized by agriculture, fisheries, placer mining, aquaculture, tourism and transport. The developmental activities provide employment and income, especially to the poverty stricken people. However, the land use pattern has not been optimal. The problem can be traced to the existing regulatory framework. For example, until the 1990's, beach placer ilmenite mining was restricted to the public sector. This restriction existed despite its huge reserves, totaling 46.41% of the world reserve, and its low (0.14%) production-reserve ratio. Similar is the case with garnet and zircon. In contrast, the recent advent of beach placer private mining has led to social conflicts between the fisher population and miners, indicating the lacunae in the mining laws. In addition, there exists a clash between people practicing aquaculture and agriculture. Even the state government of Tamil Nadu and the Union government are at loggerheads over the construction of State secretariat in the coastal stretch of Chennai. The departments of fisheries and forest fight over Krusadai Island in the Gulf of Mannar. Beach tourism, which is comparatively eco-friendly, has also been affected by the conditions that no construction activity on the seaward side of the East Coast Road project extending from Chennai to Cuddalore. Hence, the laws governing the utilization of coastal land are to be comprehensive and are to be framed at a grass root level to have built-in mechanisms for solving conflicts.

## **APPLYING STRATEGIES TO SUCCESSFULLY SUSTAIN REGIONAL COASTAL ECOSYSTEM PROGRAMS REQUEST FOR A SPECIAL SESSION OF 1 HOUR AND 30 MINUTES.**

*Jennifer McCann, Pam Rubinoff, Stephen Olsen, URI Coastal Resources Center*

This special session (1 hour & 30 minutes) has two goals:

- 1) Examine the evolution of successful initiatives at regional scales that have operated continuously for at least two decades.
- 2) Challenge the audience to work with the panelist to apply lessons learned from this examination to two other less effective regional coastal ecosystem programs, including measuring outcomes.

Stephen Olsen will present an analysis of three regional coastal ecosystem programs: Wadden Sea (Europe), Great Barrier Reef (Australia), and the Chesapeake Bay (United States of America)). He will discuss the factors that appear to be most critical to sustaining these programs over the decades. Emphasis

will be placed on the application and evolution of adaptive management; 2) institutional arrangements and governance processes; and the measurable environmental and societal outcomes that can be attributed to the efforts of each program, including how they were measured.

Pam Rubinoff will then present the Gulf of California (Mexico) case study and Jennifer McCann will present the Narragansett Bay (Rhode Island/Massachusetts/Connecticut) case study, both comparing and contrasting the approaches and techniques presented by Stephen Olsen.

The final 30 minutes of this session will be dedicated to a facilitated discussion between the panelists and the audience. Based on Stephen Olsen's presentation as well as their own experiences, the audience will advise panelists on how to implement both the Gulf of California and the Narragansett Bay programs so that these regional efforts can increase their effectiveness.

### **LARGE MARINE ECOSYSTEM-BASED APPROACH TO MARINE RESOURCE MANAGEMENT: CASE STUDY OF THE BENGUELA CURRENT LARGE MARINE ECOSYSTEM PROJECT**

*Jesse Mechling, University of Rhode Island*

Integrated or ecosystem-based management is the paradigm that most states favor for management of natural marine resources and one of the initiatives heralded within this framework is the concept of large marine ecosystems (LMEs). The three southern African states of Namibia, South Africa and Angola are currently involved in a project to manage their shared LME, the Benguela Current LME, by creating new institutional structures to strengthen regional co-operation among the states in an attempt to address the transboundary issues plaguing the BCLME including: over-exploitation of fish stocks, harmful algae blooms, habitat destruction and deterioration in water quality. These institutional structures represent the first attempt by states to operationalize LME-based management. The BCLME project is currently in its infancy and a thorough investigation of the institutional structures is not possible at this time. This paper will examine how the three states seek to implement an LME-based management approach. The paper will also discuss the effectiveness of such an approach and whether it provides the proper framework for LME-based management.

### **PUBLIC ATTITUDES TOWARD WATER QUALITY IN ILLINOIS**

*Craig A Miller, Illinois Department of Natural Resources*

A survey of 3,000 Illinois residents and 375 county-level policymakers in east-central Illinois was conducted during spring 2003. Illinois residents were stratified by those residing in east-central Illinois (a region of the state dominated by agriculture) and the remainder of the state. Response rates were 49% for residents of counties in the Lumpkin Foundation area of focus, 43% from residents of the remaining counties in Illinois, and 44% from county policymakers. A majority of Illinois residents (59%) rated water quality as the issue of highest importance out of a list of 10 community issues, including crime prevention and public school improvement. Illinois residents expressed greater concern about fertilizer, pesticide, and herbicide contaminants in their drinking water than policymakers. This concern was higher among residents in east-central Illinois than other regions of the state. Significant differences existed between policymakers and members of the public in regard to the perceived risk of contaminants in runoff from agriculture, specifically fertilizers, pesticide, and herbicide residues, which were viewed as the greatest threat to surface water by Illinois residents. Significant differences in attitudes toward water protection, regulation, and enforcement were found between members of the public and policymakers for 11 (71%) of 15 statements measuring attitudes. In general, members of the public expressed greater concern about water quality and water protection than policymakers. Discussion will include policy implications and potential conflicts over water quality in the agricultural Midwest, and impacts on coastal wetlands.

### **MEASURING THE IMPACT OF COASTAL MANAGEMENT: HOW DO WE MAKE INDICATORS WORK?**

*Elizabeth Mills, NOAA, Ralph Cantral, NOAA*

Government agencies at the international, national, regional, state, and local scales use indicators to assess the performance of governance processes for coastal management. Yet, given the complexity of governance processes, crafting performance measures that effectively track the outcomes of their efforts is

very difficult. A five-person panel will provide insight into how indicator efforts are used and coordinated among the coastal management community to provide information for improved management and government decision-making.

A representative from the National Oceanic and Atmospheric Administration (NOAA) will provide an overview of the international, national, and regional efforts to develop indicators for coastal management. A representative of NOAA Office of Ocean and Coastal Resource Management will discuss the indicators of the new National Coastal Management Performance Measurement System and how they will be used to improve planning for and reporting on the federal-state coastal management partnership established under the Coastal Zone Management Act. Representatives from a state coastal management program, a National Estuarine Research Reserve, and a National Estuary Program will present their program-specific indicators and talk about how they are used in planning, management, and budgeting, as well as how their indicator information informs state, regional, and national indicator efforts. This panel will provide insight into how indicators are developed, challenges to using indicators, varying uses of indicators at different scales, and the complementary nature of a range of indicator efforts related to coastal management governance.

#### **SUBMERGED AQUATIC VEGETATION (SAV) AERIAL HYPERSPECTRAL IMAGING AND GROUNDTRUTHING SURVEY: USE OF AERIAL HYPERSPECTRAL IMAGING IN DEFINING HAPC FOR SUMMER FLOUNDER IN A HIGH-ENERGY ESTUARINE ENVIRONMENT.**

*Alek Modjeski, ENSR*

To determine precise location of SAV areas defined by NMFS as Habitat Areas of Particular Concern (HAPC) for summer flounder, ENSR Corporation, in conjunction with Spectrum Mapping (formally 3Di Technologies), and Barry Vittor and Associates (BVA), conducted a Submerged Aquatic Vegetation (SAV) Aerial Hyperspectral and Groundtruthing Survey within Manahawkin Bay, Ocean County, New Jersey (3.75 sq. mi.). Conventional survey methodology used in Florida, Chesapeake Bay, and New Jersey were combined and modified to increase survey accuracy, increase field efficiency, and provide sufficient usable data for hyperspectral analysis and decision-makers.

The survey was conducted to identify presence and absence of SAV beds within and adjacent to a proposed project area, establish precise location and extent of identified SAV beds, and determine percent coverage of identified SAV per meter of each survey site. Additional data collected at each survey site included: substrate type; vegetation composition; relative health of SAV; blade lengths (when applicable); random stem counts; presence of hard clam (*Mercenaria mercenaria*); and water quality.

Project Overview, Methodology (modified using available resources and incorporating hyperspectral imaging technology), Results and mapping, and Conclusion comparing historical mapping efforts to results will be discussed. Further display will also discuss general overview of SAV, Manahawkin Bay, NJ (algal blooms, wasting disease, and anthropogenic stresses), conventional SAV survey methodology (Lockwood, 1991) versus hyperspectral imaging, hyperspectral imaging technology, and list various cost-effective applications of hyperspectral imagery to accurately delineate HAPC to include delineation of shoreline vegetation, wetlands, oyster and coral reefs, water quality, point-source pollution identification, and oil spills.

#### **FISH GROWTH MODELLING: GROWTH OF THE EUROPEAN ANCHOVY IN THE TAGUS ESTUARY, PORTUGAL**

*Rita Susana O. Monteiro, MSc. Modelling of the Marine Environment*

An effective management of the fisheries resources requires an understanding and the ability to predict fluctuations in abundance and biomass production. In this work a growth model is developed for individual fish and correspondent fish population in a coastal ecosystem, using the European anchovy (*Engraulis encrasicolus*) in the Tagus estuary (Lisbon, Portugal). The model involves two distinct sub-models: the individual growth model (IGM) and the population growth model (PGM). Individual fish biomass varies in each life stage as a function of its metabolic characteristics, food availability in the environment, and water temperature. The PGM is simulated in four different scenarios. From the comparison of the scenarios' results it is concluded that: (1) when a population is less fit (due to environmental stress), its growth is exponential as in an ideal situation, but with a wicker growth; (2) the

application of fishing law restrictions that save juveniles and young-of-the-year adults (<19cm) builds a fish population that tends to stabilization. The evolution of the population growth model to include movement rules according to the environmental preferences of the fish is crucial to get closer to the real world. To manage the fishing activity in a more sustainable way, it is recommended gathering and the processing of field data that permits the development of a more close to the reality model that includes each site characteristics and their influence on the evolution of the fish populations.

## **DEVELOPMENT OF AN INTEGRATED ECONOMIC-ECOLOGICAL MODEL TO ESTIMATE IMPACTS OF PROPOSED POLICIES**

*Tracey Morin Dalton, University of Rhode Island, Di Jin, Woods Hole Oceanographic Institution, Porter Hoagland, Woods Hole Oceanographic Institution*

Economic multipliers are frequently used to estimate potential impacts on selected economic variables (e.g., output and employment) of proposed public policy measures. Traditional economic multipliers are limited in the information that they convey because they only capture economic impacts from changes in the economy. They do not capture impacts from changes in the ecosystem that invariably result from natural resource extraction or use. To capture impacts on the ecosystem, resource multipliers may be constructed. In this study, an integrated economic-ecological model was developed that can be used to generate multipliers that capture interactions between economic and ecological systems. In this integrated model, an input-output model of the economic system is linked with a linear food web model of the ecosystem. To demonstrate how this economic-ecological model may be constructed, the model was applied to a coastal region in New England. Three sets of resource multipliers were generated based on the following information: (1) economic system and links from extracted natural resource stocks only; (2) economic system and links to and from extracted natural resource stocks; and (3) economic system and links to and from entire ecosystem, and interactions in the ecosystem. Results of the model suggest that multipliers vary according to information included in the model. Unlike traditional economic multipliers, impacts estimated with this model capture interactions between economic and ecological systems. In addition, the last set of multipliers captures the impacts of changes in the economic system on ecosystem components that are not directly harvested by the economy.

## **THE PORTFIELDS INITIATIVE: REVITALIZING BROWNFIELDS IN PORT COMMUNITIES**

*Robert Neely, Kenneth Walker, NOAA/National Ocean Service*

In an effort to restore coastal environments and revitalize the economies of urban port communities, the National Oceanic and Atmospheric Administration (NOAA) is leading a federal interagency effort called "Portfields." Jointly administered by the Portfields Interagency Work Group, the Portfields Interagency Initiative focuses on the redevelopment of portfields, brownfields in and around ports, harbors, and marine transportation hubs, with an emphasis on development of environmentally sound port facilities, revitalizing waterfronts, restoring coastal habitats, and leveraging public and private investment. The Interagency Work Group, the Environmental Protection Agency, the Economic Development Administration, the U.S. Maritime Administration, and the Army Corps of Engineers, as well as other federal programs have chosen three port communities to implement pilot projects: New Bedford, Massachusetts, Bellingham, Washington, and Tampa, Florida.

The goals of the project include improving the delivery of partner agencies, financial and technical resources; improving coordination among federal, state and local partners; establishing a process for redeveloping portfields properties as productive port facilities, while balancing environmental, social, and economic concerns; identifying tools, techniques, and information needs to improve decision making at portfields sites; and communicating lessons learned from the initiative to other port communities.

The Portfields project builds upon ongoing comprehensive planning efforts in the pilot ports and will allow projects identified through those planning efforts to come to fruition. In Bellingham, the port hopes to restore the mouth of Squalicum Creek, which enters Bellingham Bay at the head of the navigation channel through a narrow culvert.

**THE COASTAL LANDFORM SYSTEM SUSTAINABILITY PROJECT: AN ANALYSIS OF  
ACTIVITIES PERMITTED ON COASTAL LANDFORMS ON CAPE COD IN 1999**

*James F. O'Connell, WHOI Sea Grant & Cape Cod Cooperative Ex*

In their natural state, coastal landform systems are self-sustaining. However, human activity has become an intrinsic agent in the evolution of coastal landscapes. Human actions are a significant factor, on par with natural forces, in controlling the shape and function of our shores and coastal landforms. Thus, there is a great need to understand how individual actions on a small scale basis affect the sustainability of coastal landform systems. These systems encompass coastal bluffs, beaches, dunes, barrier beaches, salt marshes, and coastal floodplains.

Coastal landforms have their own unique beneficial functions. Some functions are critical for the health and survival of other coastal landforms within the system. Because our quantitative understanding of the interaction of coastal landform function and human activity is still evolving, particularly on a small scale basis, many decisions are made using best professional judgment without the predictive capability of knowing precisely what the impact will be to property and resources.

This study analyzed 318 permits and documented 47 different types of specific activities that were permitted on coastal landforms by local Conservation Commissions within the 15 communities on Cape Cod in 1999. A questionnaire was developed and applied to each permitted activity to quantify whether the activity added to or detracted from the beneficial functions of each coastal landform affected. The study was initiated by the Woods Hole Sea Grant Program and included active participation by a committee consisting of conservation commission agents from all 15 Cape Cod communities, the Cape Cod Commission, and a WHOI geologist.

**PANEL: THE INTEGRATED OCEAN OBSERVING SYSTEM (IOOS): CONNECTING WITH  
COASTAL MANAGERS**

*Geno Olmi, NOAA Coastal Services Center*

The Ocean U.S. Office has been charged with creating an implementation plan for a national coastal observing system. While much of the focus has been on enhancement and integration of ocean observing systems (e.g., remote sensing, buoys), meeting the needs of the coastal management community for enhanced coastal observations (i.e., monitoring) is integral to a successful IOOS. Several efforts are underway to be sure that the IOOS is developed in a manner to assist with the monitoring and management needs of the coasts. This panel session will provide an overview of the status of the emerging Implementation Plan for the IOOS and highlight progress engaging coastal managers in the design and implementation of IOOS, including emergency response and flood plain management, IOOS and indicators, regional coordination, and outreach and education. The session will include presentations by the panelists and an opportunity for questions and discussion.

**SOCIETAL GOALS TO DETERMINE ECOSYSTEM HEALTH: A FISHERIES CASE STUDY IN  
GALVESTON BAY, TEXAS**

*Anthony S. Pait, Thomas P. O'Connor, David R. Whitall, Gary C. Matlock, NOAA/National Ctrs  
Coastal Ocean Science*

Estuaries support a variety of human uses including commercial and recreational fisheries, marine transportation, and receiving waters for chemical and thermal wastes. The degree to which estuaries are meeting desired human uses is one measure of ecosystem health. Traditionally, coastal condition has been described in terms of the effects human activities have on environmental indicators. NOAA's National Centers for Coastal Ocean Science, in coordination with federal and state agencies, have recently begun an effort to assess the health of estuaries based on their ability to meet desired human uses. The questions asked include: what are society's stated uses for an estuary; how well are those uses being met; and where desired uses are not being met, how might improving one or more of the indicators affect a particular use? For the assessment of Galveston Bay, Texas, an emphasis was placed on the commercial and recreational fisheries. Results indicate that with the exception of fish contamination in a small area of the bay, and restrictions on oyster harvest over wider areas, Galveston Bay is meeting the many demands placed on it by



society. The results of the case study will appear as a chapter in the upcoming National Coastal Condition Report, jointly published by NOAA, USEPA, USDOl, and USDA.

### **EVALUATING WATER QUALITY AT SAN FRANCISCO BAY MARINAS: A PILOT STUDY**

*Ruby Pap, SF Bay Conservation and Development Commission*

San Francisco Bay hosts over sixty recreational marinas. While nonpoint pollution, such as pesticides and heavy metals from agricultural and urban runoff, is a leading cause of water quality impairment in San Francisco Bay, little is known about whether marina and recreational boating - related nonpoint source pollution is a problem in the Bay. Marina and boating operations can be a source of pollutants such as heavy metals contained in boat hull paints, engines, and marina docks and pilings; petroleum hydrocarbons from motor oils and fuels; and others. The San Francisco Bay Conservation and Development Commission (BCDC) is testing sediments for these contaminants in a pilot San Francisco Bay marina water quality study, in an effort to inform management programs that address marina and recreational boating related nonpoint pollution.

BCDC worked with a diverse stakeholder group of marina operators and recreational boaters, environmental organizations, and government agencies in developing the pilot study. Four volunteer pilot marina study sites were carefully selected to represent the wide variety of marinas in the Bay, and to isolate, as much as possible, marinas from other possible sources of pollution, such as municipal storm water. Sediments were selected to be sampled instead of water samples because of their ability to act as long term integrators. Samples were collected at approximately ten stations along a gradient from the back of each marina to the mouth. Samples are being analyzed by Moss Landing Marine Laboratories for chemical concentrations of heavy metals and polycyclic aromatic hydrocarbons (PAHs).

### **CITIZEN SCIENCE BEGETS COASTAL STEWARDSHIP: THE REEF ENVIRONMENTAL EDUCATION FOUNDATION FISH SURVEY PROJECT**

*Christy Pattengill-Semmens, Reef Environmental Education Foundation*

Effective conservation and management of marine resources requires a comprehensive understanding of ecosystem structure and function. Through concerted and persistent data collection, researchers and resource managers can gain an understanding of these ecosystem components. The monumental task of surveying and cataloging living marine resources can be daunting for managers who are typically constrained by limited budgets. Furthermore, establishing monitoring programs at a scale large enough to appropriately monitor marine communities is frequently cited as a stumbling block to effective management. One solution is to use volunteers to help collect information. Volunteer data collection, or “citizen science”, has become a widespread alternative for scientists and resource agencies needing information but lacking sufficient resources to gather it. Since 1993 volunteer sport divers have been gathering data on fish assemblages as part of the Reef Environmental Education Foundation’s (REEF) Fish Survey Project. Survey data are recorded on preprinted data sheets, which are returned to REEF and optically digitized. Data are housed in a publicly accessible database on REEF's Website (<http://www.reef.org>). To date, over 65,000 visual Roving Diver Technique surveys have been conducted at sites along North and Central America, throughout the Caribbean, and in the Hawaiian Islands. These data are useful for a variety of management applications, including evaluating the effects of harvest restrictions and zoning, identifying diversity hotspots, conducting fisheries-independent population assessments, evaluating the biogeography of fishes, and the discovery of rare, new, and non-native species.

### **NUTRIENT TRENDS IN RIVERS ENTERING THE CHESAPEAKE BAY**

*Scott Phillips, Mike Langland, Michael Senus, U.S. Geological Survey*

Chesapeake Bay, the Nation’s largest estuary, has been adversely impacted by excess nutrients. Excess nutrients have caused low dissolved oxygen levels leading to loss of fisheries and other living resources. The Chesapeake Bay Program (CBP) is leading an effort to reduce nutrient sources and loads in the Bay watershed to meet dissolved oxygen criteria in the Bay by 2010. The U.S. Geological Survey (USGS), in cooperation with several agencies, has monitored the concentration of nutrients entering the Bay since the late 1980’s. The data are used to assess trends in load and concentrations of nutrients in rivers

entering the Bay and understand the factors affecting those trends. The trend analysis revealed a large variation in the annual nitrogen and phosphorus loads to the Bay due to changes in yearly stream flow but slow reductions of the nutrient concentrations. The primary factors affecting the trends in concentration were stream flow, changes in nutrient sources, and influence of watershed characteristics (including in-stream biogeochemical transformations and the influence of ground water). All these factors influence the lag time between implementing nutrient-reduction practices in the watershed and water quality improvements in the Bay. The CBP is using these results to help refine, and assess the effectiveness of, management strategies to reduce nutrients in the Bay watershed.

### **PROMOTING SOCIAL AND CULTURAL SUSTAINABILITY OF MARINE RESOURCE CONSERVATION AND MANAGEMENT IN THE NORTHEAST**

*Patricia Pinto da Silva, Julia Olson, Lisa Colburn, Patricia Clay, NOAA Fisheries*

This poster depicts current efforts underway at the NEFSC to promote social and cultural sustainability in relation to the use of renewable marine resources. This poster visually presents the extent and variety of communities and groups involved in fishing in the Northeast U.S. by examining the spatial distribution of fisheries activity. It will also describe the research efforts underway to understand the structure and function of individual, household, and industry marine resource use through primary and secondary data collection and analysis. Links are also provided to current topics of interest, research, and community-based advocacy in the region.

### **USING SOCIAL ECOLOGY TO ENHANCE COASTAL RESOURCE MANAGEMENT: ALIGNING COMMUNITY AND AGENCY INTERESTS**

*Kevin Preister, James A Kent, Kristine Komar, James Kent Associates*

Social Ecology is the process of enhancing productive harmony between the human and physical environment, as called for in the National Environmental Policy Act (NEPA). This session explores well-developed methodologies for creating community support and consensus for coastal resource management. Used extensively by the Bureau of Land Management and the U.S. Forest Service in the West, social ecology gets below the polarization and the domination by extremist voices that are so common to environmental management. By focusing on informal levels of community, and the human geographic boundaries within which people organize their everyday lives, specific opportunities are identified for incorporating good science into local wisdom and for aligning community and agency interests. Such an approach requires a bio-social perspective in which both community and environmental health are equally important, and also requires that the proponents of public initiatives develop professional capacity for community-based approaches through mutual education and action with local residents. The session is designed in workshop format to be interactive and to include strategies to incorporate social ecological concepts back in the local settings of the participants.

### **NORTHWEST SALMON BEACHES**

*Kevin Ranker, Peter Stauffer, Surfrider Foundation*

Protection of nearshore habitats is essential to preserving the health of Pacific Northwest marine ecosystems. The shoreline and nearshore not only provide critical habitat for juvenile salmon, they also support the spawning of forage fish, which are a major food source for seabirds, marine mammals, and endangered salmon species. Unfortunately, the ecological viability of these habitats is increasingly being threatened by the cumulative impacts of coastal development and shoreline modification. Recent assessments of these areas show alarming trends in indicator species and general ecosystem health. In response to growing concerns over these impacts, the Surfrider Foundation and the Tulalip Tribes have initiated the Northwest Salmon Beaches Project. The project seeks to identify priority habitats in the nearshore of San Juan and Island County, WA that should be targeted for ecosystem-based management and spatial protection. To identify such areas, a spatial analysis has been completed of habitats that: 1) have been documented to be used by juvenile salmon; 2) have been documented to support forage fish spawning; 3) have the types of habitat correlated with 1) and 2). Additionally, studies are currently being conducted to address gaps in the existing data sets. Based on these findings, formal recommendations will be developed

for a network of intertidal protected areas in the Inland Sea of Washington State. These recommendations will be submitted to the Tulalip Tribal Council to be recognized as policy, and the Washington Fish and Wildlife Commission to be recognized through their rule making process.

**COASTAL RESOURCE ASSESSMENTS AT QUONSET-DAVISVILLE, RHODE ISLAND:  
LOBSTERS AND MARINE HABITAT**

*Jeffrey Reidenauer, Thomas Shinskey, Bernward Hay, Jeffrey Grybowski, The Louis Berger Group, Inc.*

Quonset-Davisville is a former Navy Facility on the western shore of Narragansett Bay, Rhode Island. At present, active users of the marine facility include car import carriers and fishing vessels. Recently, the access channel in the bay was planned to be dredged deeper as part of a (now discontinued) plan to construct a container port at the facility. As part of this plan, baseline biological data were collected in preparation for an EIS with the goal to minimize potential impacts to valuable resources. The waters around Quonset-Davisville are actively fished for lobsters and other shellfish by local fishermen and residents.

The lobster assessment consisted of surveys together with fishermen during different months of the year. Over 1,600 lobsters were studied. The data were integrated by the Rhode Island Department of Environmental Management. The findings revealed seasonal and spatial patterns of abundance, as well as trends in lobster sex ratios, reproduction, and shell disease. The marine habitat assessment consisted of a remote video survey of the seabed. Over seventeen hours of videotape were recorded. The data were used to create a marine habitat map of the area. Habitats were associated with different biological resources.

Approaches and findings are presented. The assessments provide valuable information for the management and preservation of the biological resources in parallel with ever-changing human uses of this coastal area in Narragansett Bay.

**A WORLD OF LEARNING IN COASTAL MANAGEMENT: CRAFTING COASTAL GOVERNANCE IN  
A CHANGING WORLD**

*Donald David Robadue, Jr, Coastal Resources Center, URI*

Over the past thirty years, there have been hundreds of international initiatives, programs, and projects that attempt to more effectively govern the world's coastal and marine ecosystems. The need for communication and knowledge sharing among groups working to address similar issues in different places is widely recognized; however, a greater emphasis upon the dissemination, integration, and analysis of this growing body of experience is required.

The Coastal Resources Center recently completed an exploration of its own experience through an international gathering which brought together coastal managers representing the experience of its work in seven countries: Ecuador, Kenya, Indonesia, Mexico, Sri Lanka, Tanzania, and Thailand. This body of experience was funded through the U.S. Agency for International Development (USAID) Coastal Resources Management Program (CRMP), which was carried out from 1985 - 2003. The CRMP promotes a learning-based approach to coastal management, and places great value in the sharing of experience. The results are available in the book *Crafting Coastal Governance in a Changing World*, two companion CD ROMs, and through a wider collection of materials on CRC's main web site, its publication catalog, and through on-going training, outreach and extension activities.

The paper provides an overview to the insights generated through this reflective process and offers guidance on how organizations can enhance their own learning processes throughout the four phases of a knowledge management process.

**MODELING SUCCESSFUL REGIONAL COASTAL ZONE MANAGEMENT: A CASE STUDY OF LOCAL  
COASTAL ZONE MANAGEMENT AT KOTOHIKIHAMA IN KYOTO**

*Asami SHIKIDA, Kanazawa Institute of Technology*

Coastal zone management is seen as one of the best solutions to achieve sustainable use of the relatively undisturbed local coastal environment. Nevertheless, little attention has been given to why and

how a successful coastal zone management has developed in a particular region. This case study attempts to analyze the development of regional coastal zone management in Amino-cho, Kyoto. The authors propose a circuit model that explains transformational changes in a management system by focusing on knowledge creation. The model can provide a useful, evolutionary design for adaptive management by introducing, sharing and creating knowledge autonomously. The authors believe that the model can be a unique and useful tool for designing a local coastal zone management system. This study may be the first to describe an appreciation of knowledge creation to coastal zone management development

#### **ASSESSING AND RESTORING LOON AND SEADUCK INJURIES FOLLOWING THE NORTH CAPE OIL SPILL**

*Molly Sperduto, USFWS, Sean Powers, Department of Marine Sciences, Michael Donlan, Industrial Economics, Dave Evers, BioDiversity Research Institute, Stewart Fefer, Gulf of Maine Program*

On January 19, 1996 the tank barge North Cape struck ground off Moonstone Beach in South Kingstown, Rhode Island, spilling over 800,000 gallons of No. 2 fuel oil. Nearly 400 dead birds were recovered. Using a multiplier to account for the proportion of dead birds not recovered, we estimated at least 2,292 birds were killed. We synthesized information on bird population dynamics to adjust for expected longevity and productivity, and to develop an appropriate restoration strategy. Sea ducks, loons, and grebes accounted for 87% of the total injury. Loons and eiders were selected as targets for restoration because of regional concern over their population status and the magnitude of injury. Three restoration options were evaluated for loons: nest site protection; nest site enhancement; and public education/outreach. Nest site protection was preferred for both loons and eiders because nest site availability and/or quality currently limit(s) productivity. Based on a series of scaling calculations, protection of 25 nest sites from loss/degradation for a 100-year period was expected to balance the loss. Four years of monitoring indicate that productivity is not as high as estimated and either additional nests or management are needed to balance the loss. Our analysis provides a means of quantifying the level of breeding habitat protection required to restore injured populations of birds.

#### **MARINE RESOURCE MANAGEMENT OF THE OSA PENINSULA & GOLFO DULCE, COSTA RICA**

*Ben Starkhouse, University of Washington*

The Osa Peninsula and Golfo Dulce region of Costa Rica is a unique marine environment that hosts a diverse assortment of vertebrates, invertebrates, bivalves, corals and marine mammals. The region's growing tourism industry, unmonitored marine species harvesting, and unsustainable land use practices are threatening the existence of several marine species and the overall health of the marine environment. As of today there are few laws and regulations in place regarding the coastal zone and open waters of the Osa Peninsula and Golfo Dulce. However, several governmental agencies, NGO's, and concerned individuals are working to increase protection of the marine environment by creating and implementing marine resource management plans and projects. My research summarizes my summer 2003 internship for an NGO based in San Jose, Costa Rica and consists of an objective look into the current health of marine resources and existing conservation plans. I conclude with suggestions for future management strategies given the area's social, economical, and environmental conditions.

#### **THE U.S. APPROACH TO THE PREVENTION OF AQUATIC NUISANCE SPECIES INVASIONS: ARE BALLAST WATER POLICIES WORKING?**

*Elizabeth Stephenson, University of Maine*

Aquatic nuisance species are organisms that pose a threat to the diversity and abundance of native species in infested waters, and to the commercial activities that depend on those waters. Aquatic invaders have wide ranging impacts, from the fouling of water-dependent infrastructure to the displacement of native species, including those that are endangered or commercially valuable. Most aquatic invaders travel to U.S. waters via ballast water. Ballast water is a primary vector for aquatic nuisance species, therefore it has been subject to various regulations and guidelines. In this poster, I will examine whether current ballast water policies are effectively protecting U.S. waters from aquatic invasions. I will present the various

federal regulations that are pertinent to this issue and discuss how the gaps in these regulations may impact aquatic nuisance species protection. Specifically, I will look at published rates of compliance with ballast water management regulations, and explore how certain regulatory exemptions may be facilitating continued invasions. I will also discuss the potential effects of proposed ballast water legislation on the prevention of aquatic nuisance species invasions. Additionally, I will address the question of whether the Environmental Protection Agency should assume jurisdiction over ballast water discharges under the Clean Water Act.

#### **MONITORING WATER QUALITY IN CHOCTAWHATCHEE BAY VIA REMOTELY-SENSED DATA**

*Scott Stoodley, Robert Huguenin, Applied Analysis Inc., Tien-Shuenn Wu, Florida DEP*

Florida Department of Environmental Protection (DEP) is investigating cost-effective means for satisfying Total Maximum Daily Loads (TMDL) development and water quality monitoring requirements. Florida has numerous water bodies listed on the 1998 303(d) list for nutrients. Efficient monitoring of these water bodies and developing accurate TMDLs will benefit from cost-effective methods of wide area surveillance. Applied Analysis Inc. (AAI) developed software for water quality monitoring based on many years of research and experience in spectral analysis algorithm development. Quantitative Shoreline Characterization 2 (QSC2) has been previously tested on water quality monitoring projects for the Department of Defense and the National Aeronautics and Space Administration.

AAI processed 4 historical Landsat TM images of Choctawhatchee Bay using QSC2 as part of this pilot study to support the development of TMDLs from remotely sensed data. The parameters quantified included suspended chlorophyll, suspended minerals, colored dissolved organic carbon, Secchi depth, and temperature. As TM imagery dates back to 1985, it allows an agency to classify water bodies where previously collected data does not currently exist or is limited in nature. Additionally, this data can be used from a modeling perspective in TMDL development or simply as a tool to identify water bodies that are impaired from an eutrophication perspective. It also spatially displays the results, thus allowing watershed managers their first synoptic, 3-dimensional look at the water body within their management jurisdiction. These spatial patterns can be a key factor in understanding potential terrestrial sources of nonpoint source pollution.

#### **CIRCULATION & WATER QUALITY ASSESSMENT AT QUONSET-DAVISVILLE, RHODE ISLAND**

*Craig Swanson, Applied Science Associates, Inc., Malcolm Spaulding, Department of Ocean Engineering, Bernward Hay, The Louis Berger Group, Inc., David Tremblay, Office of the Governor*

Quonset-Davisville is a former Navy Facility on the western shore of Narragansett Bay, Rhode Island. At present, active users of the marine facility include car import carriers and fishing vessels. Recently, deepening of the access channel in the bay was planned as part of a (now discontinued) plan to construct a container port at the facility. As part of this plan, baseline circulation and water quality data were collected in preparation for an EIS with the goal to minimize potential impacts. The assessment consisted of a long-term field component and a modeling component. The field component was designed to acquire long-term data in the dredged channels. Two moorings of five sondes were deployed to measure water quality parameters within a fifteen-month period. A current meter was deployed for three one-month periods. An analysis of the data gathered from this study as well as relevant information from other concurrent studies in the bay revealed that both local and bay-wide processes control circulation and water quality in and around the channels. The modeling component of the assessment was designed to address potential changes in stratification, dissolved oxygen, and sedimentation if the channels were deepened. A hydrodynamic, eutrophication, and sediment transport model system was applied to the bay, calibrated with the data acquired during the field study component and then used to assess changes under different potential channel depth scenarios. Approaches and findings used in the assessment are presented.

**FACTORS INFLUENCING THE SUCCESS AND SUSTAINABILITY OF INTEGRATED COASTAL MANAGEMENT IN THE PHILIPPINES; EVALUATION OF THE WORLD BANK CENTRAL VISAYAS REGIONAL PROJECT (1984-1992)**

*Monika T Thiele, School of Marine Affairs, University of Washington*

This paper shares lessons learned from an integrated coastal management study conducted in the Central Visayas Region of the Philippines. The study investigated the success and sustainability of an integrated coastal management (ICM) project called the Central Visayas Regional Project (CVRP), which was implemented by the World Bank from 1984-1992. CVRP is widely regarded as the first major foreign assisted project in the Philippines directed at integrated rural development and resource management, involving significant participation from the community, and using a watershed management approach (CVRP-1, 1992; Bojos, 1994). One of its three main components focused on near shore fisheries management and employed such interventions as mangrove reforestation, coral reef protection and marine sanctuary establishment, placement of artificial reefs and fish-aggregating devices, and mariculture. This paper discusses the relationship between a large number of socio-cultural, economic, legal, bio-physical, and institutional factors on the success and sustainability of integrated coastal management activities implemented by CVRP. Data analysis revealed statistically significant relationships between ICM Sustainability and factors related to (1) level of community development, (2) level of project decision making, (3) community structure and social cohesiveness, (4) coastal tourism, (5) project monitoring, (6) degree of leadership involvement, (7) political support, and (8) institutional capacity. Hopefully this information can be useful in the design of coastal governance structures by drawing attention to factors most influencing project sustainability.

**NEWSPAPER COVERAGE AND PUBLIC PERCEPTIONS OF OFFSHORE WIND POWER: WHAT'S THE MEDIA'S MESSAGE AND WHERE ARE THE COASTAL MANAGERS?**

*Robert Thompson, University of Rhode Island*

While Denmark has led in developing offshore wind power, the number of projects and proposals in the European Community, Canada, Central America, and the United States has grown rapidly. While offshore wind power offers clean, renewable energy, it can be controversial because it competes with other uses of coastal resources. As with any controversial coastal project, public perceptions are an important part of the political and decision-making processes. Because the media plays a critical role in creating public perceptions of the benefits, costs, and risks of offshore wind power, we need to understand how the media covers and portrays the issues. This research focused on the 130-turbine proposal for the Nantucket Shoal in Massachusetts, which has been extensively covered in the media. This research performed a textual analysis of the forty-seven newspaper articles on the project that appeared in the Cape Cod Times, the Boston Globe, and the Providence Journal. Utilizing the methods of cognitive linguists and anthropologists, the articles were analyzed to identify the cultural models that were used to conceptualize and describe the project, the permit application process, and regional and global environmental issues. A qualitative analysis computer program (NVivo) was used to code the articles using hierarchical categories and to run frequency counts to determine the relative importance of different cultural models in the newspaper's coverage of the controversy.

**CAPE COD'S COASTLINE: GOING, GOING, GONE?**

*Paul Christopher Ticco, Waquoit Bay NERR*

Coastal erosion, both temporary and permanent, is a natural geological process on most coastlines. Wind, waves, storm surges, overwash, and sea level rise all contribute to the loss of land. However, coastal erosion may also be caused by a myriad of human activities such as agricultural practices, urbanization, and the construction of seawalls and jetties. Moreover, the socio-economic effects of coastal erosion can be extensive including such problems as structural collapse, saltwater intrusion, a reduction in land and property values, septic and sewer system disruption, and the loss of valuable natural resources. Although the reasons for and the impacts of coastal erosion are numerous they are often very difficult to quantify.

As a case study, the erosion of Cape Cod's shoreline is reflective - the natural loss of coastline augmented by land use practices and public policies that exacerbate the problem. This presentation will

discuss the ongoing efforts to quantify both the physical loss of land, and the social and economic tolls that coastal erosion places upon the residents and visitors to Cape Cod, and offer coastal management solutions to combat the negative effects of shoreline loss.

### **MAINSTREAMING POPULATION AND GENDER INTO ICM: THE CRC WILD INITIATIVE**

*Elin Torell, Lesley Squillante, URI Coastal Resources Center*

For over three decades, Coastal Resources Center (CRC) has worked with partners to develop strategies for effective management of coastal environments. Core to this work has been the underlying principles of empowerment, equity, and sustainable development. Yet, CRC recognizes that the challenge of achieving sustainable coastal resource use is made much more difficult by the reality of rapidly expanding coastal populations and the lack of equity for certain segments of the population, especially women. To address these challenges, CRC, supported by the David and Lucile Packard Foundation, is leading a project to mainstream population and gender into ICM. This presentation will describe the “WILD” initiative, its progress, and lessons learned.

The project has two overarching goals: (1) to further the understanding of the linkages between population, gender, and resource management and (2) to take action on the ground to mainstream consideration of these issues into the research, design, implementation and evaluation of selected coastal management programs. The anticipated outcomes and outputs are, first, that population and gender equity issues are routinely being considered at all stages of participating ICM programs in Mexico, Indonesia, Fiji, Tanzania, Kenya, and the Philippines. Secondly, the project expects to see that knowledge, tools, experience and lessons learned on how to integrate gender equity and population change considerations into the design and implementation of coastal and marine conservation programs is being broadly disseminated amongst an active network of coastal practitioners; gender, population, and environment specialists; major NGOs; and selected members of the donor community.

### **WORKSHOP: MEASURING HUMAN VALUES & BEHAVIORS IN COASTAL MANAGEMENT**

*Theresa Trainor, Stacy Swartwood, U.S. Environmental Protection Agency*

Participatory processes are essential to successful coastal stewardship. However, do we always know what difference they make? How should we, and how can we, measure their impact? This workshop will explore the idea and use of social indicators and will learn about social science tools for systematically identifying, assessing and integrating the qualitative social and cultural aspects of coastal management. Participants should be prepared to work on specific human dimension questions or dynamics on which they or other workshop participants are working. Using the workshop tools, they will identify social indicators that can be used to measure change in that particular dynamic. Participants will then use the workshop tools to design an approach for identifying baseline information on the issue, construct a plan for action(s) to be taken to impact the issue, and develop a plan for measuring the impact of the action(s) on the issue. Tools will include social mapping, interviews, focus groups, and surveys.

### **A HAWAIIAN PILOT AQUATIC SPECIES INVENTORY AND AN EARLY DETECTION, WARNING, AND INFORMATION SYSTEM FOR INVASIVE SPECIES**

*Donna Turgeon, Gus Rassam, Lu Eldredge, Joe Stinus, Gary Matlock*

Managers need to know when a species is introduced to their region and where they can get information to help formulate response strategies. National Ocean Service, AFS, and many other partners initiated in FY02, a project that will produce an up-to-date inventory of U.S. and Canadian aquatic species, a reporting and verification system for species not on the inventory, timely warnings for species new to aquatic ecosystems, risk assessments, and other information on alien species. That project, A Hawaiian Pilot Inventory and Warning System, is being tested and data from another region should be added in FY04. A draft U.S. and Canadian inventory and warning system could be ready as early as FY08.

Visitors to the Pilot website can check new collections against an inventory of U.S. and Canadian species, map distributions, and get in-depth information on invasive species. If a species not on the inventory is confirmed as alien, a warning will be posted automatically to managers. With such warnings and information, managers will be better prepared to prevent alien species and mitigate impacts. Reducing

the potential for a species becoming established in aquatic ecosystems should also help maintain habitat structure, function, and diversity for critical fisheries habitats.

#### **MASSACHUSETTS BENTHIC HABITAT MAPPING PLAN: DETAILS ON MAP DEVELOPMENT**

*Megan Tyrrell, Susan Snow-Cotter, Anthony Wilbur, Diane Carle, Massachusetts Coastal Zone Management*

In an effort to improve marine habitat management, Massachusetts Coastal Zone Management is forming a comprehensive marine habitat management plan. The twelve major sections of the plan are briefly highlighted. One component that has already been written is the strategic plan to obtain benthic habitat maps for all Commonwealth waters. These benthic habitat maps will be instrumental in informing future resource management decisions, especially project siting. An overview of the mapping survey design will be presented, including the groundtruth sampling scheme, the parameters assessed, and the methods to delineate the polygons of various habitat types. The rationale behind the sampling design, including implications of other sampling schemes, will be discussed. These groundtruth survey and habitat delineation methods, if successful, could serve as a prototype for other broad scale habitat mapping initiatives.

#### **NONPOINT SOURCE POLLUTION REVIEW: PEW OCEAN COMMISSION RECOMMENDATIONS IN THE CURRENT LEGAL LANDSCAPE**

*Charles von Reis, University of Oregon Law School*

The Pew Ocean Commission report highlighted nonpoint source pollution stating: “Every eight months, nearly 11 million gallons of oil run off our streets and driveways into our waters - the equivalent of the Exxon Valdez oil spill.” The Clean Water Act has been instrumental in curbing point source pollution. However, it only partly addresses the nonpoint pollution. The Commission recommended several amendments to the CWA that would address issues ranging from city storm water to agricultural runoff. For example, it recommended extending current monitoring of pollutants to include destructive nutrients commonly caused by fertilization. How do the Commission’s recommendations compare to the current legal landscape? Recently, landowners challenged the EPA’s authority to impose total mandatory daily limits for pollutants on a California river polluted only nonpoint sources. (*Pronsolino v. Nastri*). The courts upheld the EPA’s authority to impose the limits under the Clean Water Act. However, citizens of Oregon unsuccessfully sued under the Clean Water Act to prevent a neighboring orchard from allegedly discharging polluted water into a waterway. (*Hiebenthal v. Meduri Farms*). Because the orchard was using the water to irrigate its trees, rather than discharging it directly into a waterway, it was considered to be coming from an agricultural field. Therefore, it was specifically exempted from the CWA’s definition of “point source.” This paper will emphasize the biggest gaps between the current legal landscape and the Commission’s recommendations. Relevant recommendations contained in the forthcoming report of the U.S. Commission on Ocean Policy will also be discussed.

#### **EVALUATING SOUTH CAROLINA’S SHELLFISH MANAGEMENT**

*Rebekah J. Walker, SC Dept. of Health and Envir. Control, William D. Anderson, SC Dept. of Natural Resources, Steve Moore, SC Dept. of Health and Envir. Control*

South Carolina’s predominantly intertidal shellfish resource, and, in particular, subtidal oyster beds, have been diminished over the years due to salinity regime changes. Shellfish are still abundant along the coastline, but comparisons between recent and historical surveys and fishery dependent data reveal the resource may be over harvested in certain areas. It is important to insure that shellfish are being adequately protected through proper management. Culture Permit Areas are leased bottoms used by commercial harvesters for cultivation, and make up approximately 85% of the harvestable shellfish beds in the state. Most of the remaining 15% is State Shellfish Grounds (SSGs), a common property resource that can be used by both independent commercial and recreational harvesters. Harvest levels have remained relatively stable over the past ten years and in 2001 South Carolina produced more oysters than North Carolina, Georgia and the east coast of Florida combined. However, a disproportionate portion of the landings is



taken from the SSGs suggesting continued long-term sustainability of these grounds may need more active management. A NOAA Coastal Management Fellow was hired to evaluate state laws and policies to determine if South Carolina's shellfish resources are adequately protected. Landings, water quality, and harvester data were analyzed to determine if notable trends existed. In addition, the laws and policies of South Carolina were compared with other Atlantic and Gulf states with shellfish industries. The state's capacity to manage shellfish resources in both the leased and public bottoms is analyzed and alternative methods of effective management are discussed.

#### **LEGAL ISSUES RELEVANT TO COASTAL RESTORATION PROJECTS: THE LOUISIANA EXPERIENCE**

*Michael W. Wascom, Dept. of Envir. Studies, LSU, James G. Wilkins, Louisiana Sea Grant Legal Program*

Coastal erosion has become a problem for many states. This is particularly true of Louisiana, which loses 25 square miles of coastal wetlands each year, or 80% of all coastal wetland loss in the continental U.S. State (LWCRA)) and federal (CWP funding have coalesced around Coast 2050, a plan for coastal restoration.

In Louisiana, carrying out these large scale publicly-funded restoration projects has led to legal issues not contemplated by Louisiana Civil Code, which addresses loss of land from erosion and private reclamation rights. The ownership of accreted land resulting from large scale, publicly-funded projects and compensation for relocation of oyster leases were problems not contemplated. In fact, voters have adopted two constitutional amendments to resolve these problems, at least partially.

Other issues that will have to be addressed include the adverse affects of the freshening of coastal waters on businesses other than oyster farming, changes in flooding patterns as coastal geography is altered, and the need for flowage easements from river diversions. This presentation will discuss these legal issues that have arisen/will arise from publicly funded projects, with the hope that other states can learn from the Louisiana experience.

#### **USING BIOLOGICALLY IMPORTANT PHYSICAL CHARACTERISTICS OF ESTUARIES TO CLASSIFY AUSTRALIAN AND NEW ZEALAND ESTUARIES.**

*Michael Whelan, Southern Cross University, Peter Saenger, Southern Cross University, Terry Hume, NIWA, Michael Digby, Queensland Parks and Wildlife Service*

Australian estuaries (780) were classified using, biologically important, physical characteristics (parameters describing catchment, climate, morphology, flow and tidal range) of estuaries. Mangrove and saltmarsh area were used as dependent variables in General Linear Modeling. The climatic zoning of the estuary was the dominant physical characteristic and divided the estuaries into five classes. Tidal range at the estuary mouth was the second most important characteristic. Including the proportion of intertidal area generated, a classification with twenty-three classes that explained 50.4% and 42.5% of the variation in mangrove and saltmarsh area, respectively. The developed database is used by managers to classify and investigate estuaries throughout Australia.

The same method was used to classify estuaries on the North Island of New Zealand. Maximum wader abundance and the maximum number of species recorded (1983-1994) at ninety-four estuaries were related to physical attributes of the estuaries. Analysis revealed strong positive relationships between the size and diversity of a wader population and estuary area. A negative relationship between catchment runoff and wader abundance and diversity existed in some estuaries. The model predicted that relatively small estuaries (100 to 999 ha) could support large, diverse wader populations if catchment runoff was low. This paper demonstrates how measurement of physical characteristics of estuaries can be used to classify estuaries and predict the ecological importance of estuaries where thorough fauna and flora surveys are not available.

## **PROTECTING COASTAL RESOURCES IN CUBA: A LOOK AT CURRENT LAWS & INSTITUTIONS**

*Daniel J. Whittle, Environmental Defense*

Cuba is the by far the largest and most ecologically diverse island in the Caribbean, and its extensive coastal areas are still home to massive mangrove wetlands, tropical wet forests, coastal mountains, and a variety of associated habitats for a diverse range of plants and animals. Over the last decade, the Cuban government has made environmental protection a national policy priority. Since 1993 Cuba created a new and powerful environmental ministry, developed an environmental framework law, and passed a number of progressive environmental laws. These include a far-reaching coastal zone management law and a law requiring environmental review of major construction projects and other activities affecting the environment. Strengthening environmental policy in Cuba comes at a critical time when international tourism, particularly in coastal areas, has become the number one industry in the country, far out-pacing revenues from the country's declining sugar industry. While official government policy requires that tourism development be economically, environmentally, socially and culturally sustainable, Cuba's young environmental protection policies are being tested by aggressive efforts within and outside of the country to develop new tourist facilities on along undisturbed barrier islands and other ecologically rich and sensitive coastal areas. If the United States eases or lifts the economic embargo and/or ban on travel to Cuba, more than a million American tourists are projected to flood the Island in the first year alone. This paper will examine Cuba's efforts to develop and implement a legal and institutional infrastructure to protect its abundant and diverse coastal and marine resources.

## **OCEAN ZONING FOR THE GULF OF MAINE**

*Jack Wiggin, Urban Harbors Institute, Fara Courtney, Good Harbor Consulting*

Ocean managers worldwide are investigating new methods for equitably allocating the use of limited marine resources while protecting the integrity of the ocean ecosystem. Ocean zoning is one method which, like its land-based counterpart, attempts to reduce user conflicts by separating incompatible activities and allocating or distributing uses based on a determination of an area's suitability for those uses.

The challenges of establishing an ocean zoning system are scientific and technical as well as political and social. The effectiveness of ocean zoning as a management tool is dependent on an understanding of the natural resources, the complex biological relationships within an ecosystem, and the requirements of economic users. Fundamental to such a management system is the ability to establish zone boundaries. New technologies and approaches are instrumental in providing the data to do this and the means to share it with affected parties.

The paper presents an overview of how the concept of zoning is applied in the marine context and provides a range of examples of spatially explicit ocean use management systems from around the world. The paper describes challenges and opportunities, new technologies and tools, and issues associated with emerging uses such as offshore wind farms and aquaculture development - all in the context of current initiatives by the United States and Canada to develop new, comprehensive ocean policies. The paper was prepared for the Gulf of Maine Council on the Marine Environment to assist with the Council's consideration of how ocean zoning might contribute to its marine sustainability goals.

## **THE SURFRIDER FOUNDATION 2004 STATE OF THE BEACH REPORT**

*Rick Wilson, Chad Nelsen, Surfrider Foundation*

In 1999 the Surfrider Foundation, an international coastal environmental organization, initiated its State of the Beach report to provide an annual update on the status of our nation's beaches. The fifth State of the Beach report was published this month and is available online at [www.surfrider.org/stateofthebeach](http://www.surfrider.org/stateofthebeach). The State of the Beach report is becoming a measuring stick by which local citizens, government officials, and coastal zone managers can judge the health of their beaches. The report now covers twenty-two states and territories and evaluates the amount of readily available information and the status for nine beach health indicators. The indicators are:

- Beach Access
- Surf Zone Water Quality
- Beach Erosion
- Beach Fill ("Beach Nourishment")
- Shoreline Structures
- Erosion Response
- Beach Ecology (new for 2004)
- Surfing Areas
- Web Site

To compile the information for the State of the Beach report, Surfrider searches each state's coastal management web sites and contacts each of the state coastal management program offices via telephone and/or e-mail to ask for additional information. The report evaluates each indicator for each state based on the availability of information and the status of each indicator as compared to identified criteria.

Although the availability of beach health indicator information is increasing, Surfrider still finds relatively sparse information available on many Beach Health Indicators. Overall, the results of this study point to the need for more complete and more easily accessible information that can be used to measure the status of our coastal environment.

## **MONITORING POTENTIAL WATER QUALITY IMPACTS OF COASTAL CONSTRUCTION PROJECTS**

*Steven Wolf, ENSR Corporation, Jay Mackay, U.S. Army Corps of Engineers*

Coastal stewards are faced with decisions on many large projects that involve construction within and adjacent to coastal areas. Projects such as channel dredging or installation of submerged pipelines may cross many miles of coastal waters and may take place over extended timeframes. As part of the permitting for these projects, assessments can be made of the potential for water quality and benthic impacts using sophisticated computer models that predict the release and transport of sediments and any associated chemical constituents. Once a project is through the permitting phase, monitoring of actual impacts during construction can pose a formidable set of challenges.

This paper will provide a primer on water quality monitoring. It will include a review of the types of impacts (physical and chemical) and will focus on the technological advances in monitoring equipment that allow for a comprehensive and often real-time assessment of potential impacts. Monitoring techniques that will be reviewed include the multi-parameter water quality meter, the acoustic Doppler current profiler, underwater video camera, and sediment-profile imaging camera. Application of these techniques will be presented for a range of recent coastal projects including channel maintenance dredging in Providence RI, remediation dredging in New Bedford MA, and natural gas pipeline installation in Long Island Sound and Massachusetts Bay.